Vol. 12, No. 7
April 15, 1987

Energy Research Abstracts

Abstracts 13014-15265

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT INFORMATION ON ENERGY

To provide immediate and complete coverage of literature related to major Department programs, the Office of Scientific and Technical Information provides an on-line retrieval system, data bases, and current-awareness publications. The Energy Data Base (EDB), which contains all unclassified, unlimited energy and nuclear related information processed by OSTI since 1974, and the Nuclear Science Abstracts Data Base (NSA), which covers nuclear information from 1948 through June 1976, are available for machine searching using commercial on-line retrieval systems. All information in the publications listed below, plus additional backup information, is included in the EDB. Current information being added to the EDB is available for on-line searching via the OSTI Automated Retrieval System (OARS) accessible to DOE and contractors through the Integrated Technical Information System (ITIS).

The publications described below and access to ITIS/OARS are available to Department of Energy and contractor components from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831/Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

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DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available as PB87-946800 from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 on a standing order basis through an NTIS Deposit Account. To establish an NTIS account, send the minimum $25.00 deposit to NTIS, Attn: Customer Accounts. A single issue is $12.00 for domestic (North America) and $24.00 for foreign (outside North America).

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB87-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $70.00 for domestic subscribers and $140.00 for subscribers outside the North American continent; a single issue is $8.00 and $16.00, respectively.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $80.00 for domestic (North America) and $160.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

Acid Precipitation (APC)–**PB87-901000.** Acid precipitation, including effects and possible control measures.

Buildings Energy Technology (BET)–**PB87-900700.** Technology required for energy conservation in buildings of all types.

Coal-Based Synfuels (CBS)–**PB87-901400.** Conversion of coal into gaseous or liquid fuels.

Coal Combustion and Utilization (CCU)–**PB87-914400.** Coal combustion, including fluidized bed combustion, and direct utilization of coal for power generation, fuel cells, and MHD generators.

Coal Preparation and Pollution Control (CPC)–**PB87-900800.** Coal preparation and cleaning and reducing pollution from its direct combustion.

Direct Energy Conversion (DEC)–**PB87-946600.** Photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

Energy from Biomass (EFB)–**PB87-900600.** Biomass production, conversion, and utilization for energy.

Geothermal Energy Technology (GET)–**PB87-914700.** Exploration, development, and utilization of geothermal resources.

Heavy-Ion Reactions (HIR)–**PB87-900500.** Heavy-ion ($A > 4$) reactions.

Laser Research (LAR)–**PB87-901100.** Laser research and development, excluding applications.

Nuclear Fuel Cycle (NFC)–**PB87-913400.** Both front and back ends of the nuclear fuel cycle.

Nuclear Reactor Safety (NRS)–**PB87-913500.** Accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

Radioactive Waste Management (RWM)–**PB87-902900.** Management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

Solar Thermal Energy Technology (STT)–**PB87-901200.** Research and development of efficient and reliable solar thermal conversion systems.

Transportation Energy Research (TER)–**PB87-900900.** Energy-efficient advanced automotive propulsion systems and transportation energy conservation.

Unconventional Petroleum (UCP)–**PB87-901300.** Secondary and tertiary recovery of petroleum and oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from Bernan Associates—UNIPUB, 10033-F King Highway, Lanham, MD 20706. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $355.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information on the conversion of biomass to energy. *Biomass Abstracts* is available free to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 60 IR pounds per year for participating countries and 90 IR pounds per year for nonparticipating countries. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 110 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Although the literature of science is emphasized, coverage extends to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish the mission of furnishing centralized support for Departmental elements in managing their scientific and technical information, OSTI builds and maintains computerized data bases and disseminates information via computerized retrieval systems and announcement publications such as abstract journals, bibliographies, and bulletins. Direct access to OSTI's Energy Data Base (EDB) and Nuclear Science Abstracts Data Base (NSA) is available to the U. S. scientific community through commercial on-line retrieval systems. Access to these data bases from outside the United States is available only through formal exchange agreements. The current-year EDB records, DOE Research-In-Progress, and various other specialized DOE data bases are available to DOE offices and contractors and other government agencies through the OSTI Automated Retrieval System (OARS), which is a major component of the Integrated Technical Information System (ITIS). In addition to providing access to the OSTI on-line systems, ITIS serves as a gateway to other government and commercial systems and provides information merging for customized information products. The Office of Scientific and Technical Information has developed systems to record and communicate energy-related research-in-progress information, to track research report deliverables from DOE contractors, to test and make available DOE-funded computer software programs with scientific and management applications, and to produce special publications in support of DOE program offices. To manage DOE's technical information resources effectively, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161.

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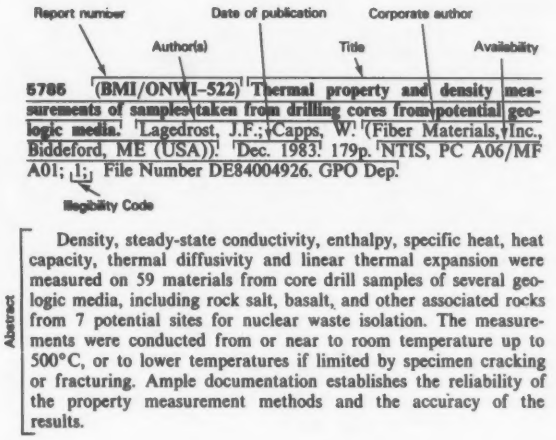
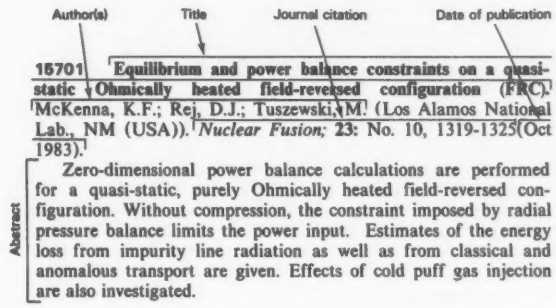
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5786 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
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Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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Springfield, VA

National Institutes of Health
National Library of Medicine
Bethesda, MD

NOVA Information Services Company
Commack, NY

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 41 first-level and 276 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 41 first-level and 276 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

13014 **(DOE/PETC/QTR—86/3) [Pittsburgh Energy Technology Center]: Quarterly technical progress report for the period ending June 30, 1986.** (USDOE Pittsburgh Energy Technology Center, PA). Feb 1987. 157p. NTIS, PC A08/MF A01. File Number DE87005062.

A concrete example of third-party involvement was announced this June when the Illinois Coal Development Board voted to provide $1 million to UOP, Inc., in support of the proof-of-concept testing of the PETC Fluidized-Bed Copper Oxide Process for flue gas cleanup. In yet another joint effort, PETC and Argonne National Laboratory are cooperating on the simultaneous removal of SO_2/NO/sub x/ pollutants in the dry scrubbing of flue gas from high-sulfur coal. A test plan using sodium hydroxide as the additive is being developed for Argonne's 20-MW spray dryer unit. Biological conversion of coal-derived synthesis gas to alcohols or liquid hydrocarbon fuels represents a promising new approach to indirect coal liquefaction. Researchers at the University of Arkansas recently detected the presence of both ethanol and n-butanol in bioconversion products. The alcohols were produced through use of carbon monoxide or acetate as the primary carbon source in biological cultures treated for inhibition of methane formation. A novel process to convert methane to higher hydrocarbons has been developed at PETC. Also at PETC, a method of oxidatively solubilizing coals through low-temperature treatment with nitric acid has been developed and has shown that mixtures of the solubilized coal in alcohols are good diesel fuels. As a result of work performed as a DOE contractor, Union Carbide Corporation has filed three records of invention with the DOE Patent Counsel. The improvements in synthesis gas conversion technology resulting from these inventions potentially offer a significant advancement over existing catalysts and process systems for the direct conversion of synthesis gas to liquid fuels. The Michigan Technological University is preparing a patent application for a new on-line, real-time ash analyzer developed under a DOE research grant.

0103 Preparation

REFER ALSO TO CITATION(S) 13069, 13081, 13124, 13129

13015 **(CONF-860810—46) Gasification characteristics of de-ashed and desulfurized coals.** Punwani, D.V.; Hill, A.H.; Feldkirchner, H.L.; Leppin, D. (Institute of Gas Technology, Chicago, IL (USA); Gas Research Inst., Chicago, IL (USA)). 1986. 8p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900437.

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

Many physical and chemical coal cleaning processes are being developed to reduce the ash and/or the sulfur contents of coals. The primary objective in developing these processes is to reduce sulfur emissions and/or to produce coal-water slurries for combustion systems. Coals cleaned by some of these processes may have advantages as gasifier feedstocks. The potential advantages may include: (1) higher reactivity, (2) increased catalyst recoverability, (3) reduced hydrogen sulfide in the gasifier effluent, and (4) reduction in size or simplification of the gasifier ash-discharge system. Under a program funded by the Gas Research Institute (GRI), the Institute of Gas Technology (IGT) is determining the gasification-related properties of de-ashed and desulfurized coals produced by two selected coal cleaning processes. One of the selected processes is a physical cleaning process and the other is a chemical cleaning process. This paper presents the results of the laboratory-scale tests conducted with a bituminous coal before and after being cleaned by a physical cleaning process. 11 refs., 6 figs., 8 tabs.

13016 **(DOE/PC/81210—T13) Development and demonstration of a static tube flotation system for producing superclean coal: 5th quarterly technical progress report (ending 12/31/86).** Yang, D.C. (Michigan Technological Univ., Houghton (USA). Inst. of Materials Processing). 15 Jan 1987. Contract AC22-85PC81210. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004381.

The primary objective of the project is to produce a superclean coal allowing production of coal-based fuel at a cost which is less than 80% of the cost of a thermally equivalent petroleum-based fuel. The secondary objectives are to determine the efficiency of the separation achieved by the MTU flotation technology on coals of varying rank and origin, and to establish the effect of coal parameters such as ash content, ash mineralogy, and ash liberation size on the economics of superclean coal production. The work conducted during this quarter was mainly devoted to Phase II - Flotation Circuit Development as a preparatory step to the proposed pilot plant demonstration which will be run in a two-stage circuit and will take place in September, 1987. Task 8 "Optimization of Flotation Conditions" is in progress using the two selected coals, i.e., the Pittsburgh seam coal from Pennsylvania and the Lower Kittanning coal from Ohio. This selection, based not only on cleanability of these coals but also on their large reserves, was agreed to by the DOE Technical Project Officer in a project review meeting held at Michigan Tech in October of 1986. Some duplicate tests were conducted to substantiate the previously reported data and improve upon them by optimizing grind and reagents as well as the operating parameters. The results show that a superclean coal of $<2\%$ ash can be produced with $>80\%$ Btu recovery for both coals if they are ground to 90% -22 microns or finer. A decision was made to grind the 1st stage feed to 50% -22 microns to match the estimated capacity of the existing pilot plant facility at Michigan Tech for coal grinding at 1000 lbs/hr throughput. A DRAIS Perl Mill, either the lab or the pilot plant model, will be used for the 2nd stage grinding. The results of the laboratory simulation tests indicate a more efficient overall performance with the two-stage flotation than that of the single stage. 2 figs., 2 tabs.

13017 **(IS—4911) Stabilization of coal cleaning wastes: Fossil Energy Program: Technical progress report, 1 July 1986-30 September 1986.** Burnet, G.; Gokhale, A. (Ames Lab., IA (USA)). Oct 1986. Contract W-7405-ENG-82. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004550.

Use of fly ash as a diluent to reduce the fuel content in green pellets of coal refuse was reexamined. When sintered, the green pellets formed showed reduced durability and pellet strength, compared to pellets of refuse only and hence this option was discontinued. Green pellets made from coal refuse ground using two passes through a hammer mill were sintered in the fixed bed combustor. Bed height was found to have an insignificant effect on the quality of the sinter. Starting with combustion air immediately after the introduction of green pellets into the reactor (no preheating) resulted in improved combustion and sintering. The average force required to fracture these pellets was 30 to 40 pounds. The relatively low strength was due to the inability to obtain uniform and controlled sintering throughout the bed in the combustor. More uniform sintering was obtained by placing the pellets in a large perforated ceramic boat in a tube furnace. Black-brown pellets from the boat tests were very strong, requiring 150-200 pounds to fracture, and were subjected to the standard ASTM/EP leaching tests. A computerized literature search of NTIS and Chemical Abstracts was used to update information about prior and current work. Exploratory work on the co-stabilization of coal refuse and FGD sludge showed that durable green pellets could be formed when the

necessary values for FGD sludge content in feed, inclination of the rotary pan of the agglomerator, and moisture content were used. 4 figs., 4 tabs.

13018 **(IS—4915) Development of chemical methods for selective removal of trace elements from coal: Final report.** Norton, G.A.; Markuszewski, R.; Araghi, H.G. (Ames Lab., IA (USA)). Dec 1986. Contract W-7405-ENG-82. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004551.

Various chemical treatments were found to be effective at reducing levels of many trace elements from selected coals. Leaching Illinois No. 6 coal with HNO_3 significantly reduced levels of Be, Mn, Ni, Pb, and Zn. Trace element reductions were generally less pronounced for Lower Kittanning coal leached with HNO_3, although As levels were reduced by 90%. Molten NaOH/KOH and hot aqueous Na_2CO_3 treatments followed by acid washes significantly reduced levels of many trace elements in Illinois No. 6 and Pittsburgh No. 8 coals. Treating run-of-mine Illinois No. 6 coal with aqueous Na_2CO_3 at elevated temperatures and pressures and subsequently washing the coal with acid reduced levels of Cd, Mn, Ni, Pb, and Zn by 50% or more. In one sample treated with hot aqueous Na_2CO_3, levels of Ba, Rb, and Sr were also reduced substantially. Coals which were treated with hot molten caustic at atmospheric pressure showed substantial reductions in concentrations of As, Cd, Hg, Pb, Rb, Se, Sr, and Zn. Several elements, such as Cr, Cu, and Ni, were elevated in some of the coals treated with caustic or alkali. This can be attributed to corrosion of reactor components. 47 refs., 15 tabs.

13019 **(IS—4916) Development of an on-line pyrite monitoring instrument: Final report.** Benson, J.E.; Struble, R.E.; Jacobson, R.A. (Ames Lab., IA (USA)). Dec 1986. Contract W-7405-ENG-82. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004563.

The design, construction, operation, and performance of a pyrite monitor for use in coal cleaning production plants is described. The analytical method used is that of x-ray diffraction. It has been demonstrated that pyrite and most other minerals, even if embedded in a coal matrix, still yield sharp characteristic diffraction patterns which are superimposed on the broad diffuse peaks due to coal itself. The monitor has been designed to measure the strong, characteristic pyrite diffraction peak at 15.10° 2θ obtained by using a molybdenum K/sub α/ x-ray source. Use of this source appreciably reduces absorption effects; therefore, percent pyrite can be obtained from the pyrite diffraction intensity via a simple calibration curve. A sample delivery system incorporating a computer-controlled moving belt mechanism is an integral part of this instrument and ensures the monitoring of a reasonable fraction of the coal stream. The x-ray detector scans a 3° range centered on the pyrite peak under computer control; intensity data are then smoothed, background is subtracted, the percent pyrite determined, and the results displayed on the computer's monitor screen. Operation is via response to menu items on a computer screen; stored data can be displayed in a variety of forms. Results obtained for a number of coals from various sources show good agreement (+-0.2%) with ASTM wet chemical analysis and with measurements taken over extended times. 7 refs., 7 figs., 4 tabs.

13020 **(PB—87-104535/XAB) Evaluation of conventional and advanced coal-cleaning techniques. Final report, April 1982-September 1984.** Onursal, A.B.; Buroff, J.; Strauss, J. (Versar, Inc., Springfield, VA (USA)). Sep 1986. 385p. NTIS, PC A17/MF A01.

The report assesses the capability, cost, and environmental effects of coal cleaning to reduce sulfur dioxide (SO_2) emissions. It is the culmination of a 4-year program directed by EPA's AEERL. The report includes evaluations of SO_2 emission reductions by cleaning coals on a state and regional basis; descriptions of coal-cleaning equipment; calculation of environmental tradeoffs; development of algorithms for coal-cleaning capital costs, operation and maintenance costs, and cost benefits; brief descriptions of advanced coal-cleaning processes; summaries of coal and utility industry trends relative to coal cleaning; and development of a utility-system-based model for calculating SO_2 emission compliance costs using coal cleaning, blending, and flue-gas desulfurization options. The report notes that 85% of the SO_2 emission reductions produced by coal cleaning would be attained from coals in the Northern Appalachian and Eastern Midwest regions.

13021 **(PB—87-120515/XAB) Assessment of coal-cleaning technology: final report. Report for January 1977-January 1981.** McCandless, L.C.; Onursal, A.B.; Moore, J.M. (Versar, Inc., Springfield, VA (USA)). Oct 1986. 209p. NTIS, PC A10/MF A01.

The report gives results of tests at seven coal-preparation plants to evaluate the performance of froth flotation cells and dense-medium cyclones in removing ash and sulfur (S) from fine coal (Minus 28 mesh). Flotation circuits tested at four plants showed substantial reductions in coal ash content (64-88%), pyritic S content (48-65%), and sulfur dioxide (SO_2) emission (expressed as ng SO_2/million Btu; 15-87%) at mean weight recoveries of 11-54%. Raw and clean coal data sets were found to exhibit statistical properties that can be characterized by time series models. The use of low-S coal, PCC, or chemical coal cleaning (CCC) was evaluated for compliance with potential SO_2 emission limits for industrial boilers. PCC can achieve moderate S reductions in (high S) Northern Appalachian and Midwestern coals, but few of these coals can be cleaned to meet a 516 ng SO_2/million Btu standard. Many Southern Appalachian, Alabama, or Western coals are capable of meeting the standard as mined or after cleaning.

0104 Processing

REFER ALSO TO CITATION(S) 13015, 13015, 13020, 13076, 13079, 13168, 13321, 13341, 13341, 13690, 13691, 13692, 13693, 13694, 13695, 13696, 13697

13022 **(CONF-860810—44) Coal gasification activities in Europe.** Lee, B.S. (Institute of Gas Technology, Chicago, IL (USA)). Aug 1986. 5p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900435.

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

The recent sharp decline in world oil prices has had the predictable effect of forcing out marginal producers and causing the abandonment of alternative energy technology development. Such short-sightedness must be rectified in order to seize this opportunity to prepare for the inevitable long-term need for alternative energy sources. Coal gasification remains the key technology for the increased utilization of coal. This paper reviews the major European activities in this field and highlights the significant features of each project. 10 refs.

13023 **(CONF-860948—2) Wet carbonization of lump-size low-rank coals.** Rue, D.M.; Lau, F.S.; Roberts, M.J. (Institute of Gas Technology, Chicago, IL (USA)). Sep 1986. 33p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900445.

From 3. annual Pittsburgh coal conference; Pittsburgh, PA, USA (8 Sep 1986).

Wet-carbonization of lump-size coals produces an improved solid product with: Heating value improvement up to 14%; lower equilibrium moisture content, down to 8%; less particle-size reduction when air dried, by a factor of 4; and sodium content reduction up to 80%. Thus, the wet-carbonized product with an improved heating value, lower equilibrium moisture content, better handling characteristic and lower sodium content has the advantages of: Improving the economics of transporting these coals to market; improving their combustion efficiency and characteristics; making them competitive with desulfurized high-rank coals in combustion systems; and improving the economics of several gasification and direct liquefaction systems. 13 refs., 17 figs., 4 tabs.

13024 **(CONF-860948—3) Operation of a high-pressure ash-agglomerating coal gasifier.** Goyal, A.; Rehmat, A.; Sandstrom, W.A. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 16p. Institute of Gas Technology, 3424 S. State St., Chicago, IL 60616. File Number TI87900443.

From 3. annual Pittsburgh coal conference; Pittsburgh, PA, USA (8 Sep 1986).

A high-pressure Process Development Unit (PDU) has recently been constructed by the Institute of Gas Technology (IGT) to develop a data base for the ash-agglomerating, fluidized-bed gasification characteristics of different coals at elevated pressures. It has been operated at pressures up to 300 psig and at temperatures dictated by individual coal gasification requirements. Sufficient data have been obtained from this PDU to characterize the effect of pressure on the gasification of Montana Rosebud subbituminous coal and North Dakota lignite. Data with bituminous coals at pressures up to 135 psig have also been obtained. Encouraged by its recent successful operation at pressures up to 300 psig, IGT has recently upgraded the PDU to enable testing at pressures to 500 psig. A program for testing different American coals at this pressure has just begun. The recent testing and upgrading has been funded by the Gas Research Institute. 6 refs., 6 figs., 3 tabs.

13025 **(CRIEPI—285015) A study on flow and mixing characteristics in entrained-bed coal gasifier. Part 1.** Inumaru, J. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.). 1986. vp. (In Japanese). Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.

An experimental study using a water flow model was carried out in order to investigate the flow pattern and mixing process in a 2T/D entrained-bed coal gasifier. The advanced flow visualization system with light-scatter technique was utilized for measurements of concentrations in the mixing field of the water model. It was confirmed that the inverse flow existed along the central axis of the reactor and the burner flow rate had a great influence on the flow and mixing process in the gasifier.

13026 **(CRIEPI—285030) The long term performance of desulfurization sorbents repetition of desulfurization/regeneration.** Shirai, Y. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.). 1986. vp. (In Japanese). Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.

This paper describes the long-term performance of hot-gas desulfurization sorbents. Between 100 and 200 times desulfurization/regeneration cyclic tests were given to two different particle sorbents and one honeycomb sorbent. By using a number of moles of reacted H_2S per g-sorbent by 100 ppm H_2S breakthrough, zhe long-term performance was evaluated. The particle sorbents did not deteriorate and kept the initial performance for 100 time repetition tests. The honeycomb sorbent deteriorated as to reduce the performance to one half of the initial one at 150 times cycles, but kept constant more than 150 times.

13027 **(DOE/PC/40782—T7) Desulfurization with transition metal catalysts: scope and mechanism of cleaving carbon-sulfur and carbon-nitrogen bonds with subvalent organotransition-metal complexes: Final technical report, September 27, 1981-December 31, 1983.** Eisch, J.J. (State Univ. of New York, Binghamton (USA). Dept. of Chemistry). 1983. Contract FG22-81PC40782. 37p. NTIS, PC A03/MF A01. File Number DE87002559.

Our fundamental interest in this research is to understand the reaction mechanisms whereby lower valent transition-metal complexes bring about the cleavage of relatively weak pi- and sigma-covalent bonds. Such a long-range physical-chemical investigation should put the effects of the metal's electronic configuration, the ligands on the metal and the nature of the solvent on a more rational basis. As an ultimate result, a more systematic approach to varying the reactivity of transition-metal catalysts ought to be attainable. The design of new catalytic systems, in general, and of new catalysts for heteroatom removal, in particular, should profit from our studies. The specific rationale of our investigation has been to choose a variety of organosulfur and organonitrogen compounds, with which to evaluate the desulfurizing and denitrogenating action of low-valent transition metal complexes. Such organic compounds were selected for study, because they closely resemble the kinds of sulfur- and nitrogen-containing structures occurring in coal or coal-liquids themselves. As model compounds, we have examined aryl mercaptans, sulfides and disulfides, aromatic sulfur heterocycles (diobenzothiophenes, thianthrene, phenothiazine and phenoxathiin), pyrrole derivatives and benzopyridines. Once the most favorable choice of experimental variables is attained with the model nitrogen- or sulfur-containing compound, then the heteroatom-removing reagent is applied to an actual coal liquid. Results on desulfurization and denitrogenation of model organic compounds and coal liquids are reviewed. 27 refs., 6 tabs.

13028 **(DOE/PC/40795—T13) Conversion of low H_2/CO ratio synthesis gas to hydrocarbons: Final report, October 1, 1981-September 30, 1986.** Bell, A.T.; Heinemann, H. (California Univ., Berkeley (USA). Dept. of Chemical Engineering). 1986. Contract FG22-81PC40795. 12p. NTIS, PC A02/MF A01. File Number DE87004506.

The objectives of this project have been twofold: (1) to develop a theoretical model for designing bubble-column reactors and assessing their performance and (2) to characterize the performance of a laboratory-scale bubble-column reactor. The theoretical part of the project has focused the effects of gas-liquid mass transfer; axial dispersion of gas, liquid, and catalyst; ad the interplay between the kinetics of Fischer-Tropsch synthesis and the water-gas-shift reaction. The experimental portion of the project has focused the effects of reaction conditions on product distribution and, in particular, the conditions under which gas-liquid mass transfer becomes important. Any independent set of experiments was undertaken to investigate the chemistry of carbonaceous deposits formed during Fischer-Tropsch synthesis. 8 refs.

13029 **(DOE/PC/50791—T4) Fischer-Tropsch synthesis from a low H_2:CO gas in a dry fluidized-bed system. Volume 2. Development of microreactor systems for unsteady-state. Fischer-Tropsch synthesis. Final technical report.** Whiting, G.K.; Liu, Y.A.; Squires, A.M. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemical Engineering). 1 Oct 1986. Contract FG22-82PC50791. 458p. NTIS MF A01. File Number DE87000287.

Vibrofluidized microreactor systems have been developed for studies of unsteady-state Fischer-Tropsch synthesis. This development is aimed at preventing carbon deposition on a fused-iron catalyst in a novel reactor called the "heat tray." This reactor involves a supernatant gas flowing over a shallow fluidized bed of catalyst particles. Three systems were built: (1) a vibrofluidized-bed microreactor system for obtaining baseline carbon deposition information under industrially important reaction conditions; (2) a sliding-plug vibrofluidized-bed microreactor system for rapid switching of feed gases in the F-T synthesis; and (3) a cold-flow microreactor model for studying the gas mixing characteristics of the sliding-plug vibrofluidized-bed microreactor. The results show that catalyst defluidization occurred under steady-state synthesis conditions below 395 C using a feed gas of H_2/CO ratio of 2:1 or less. Above 395 C, the probability of hydrocarbon chain growth ($\alpha < 0.50$ to prevent accumulation of high-molecular-weight species that cause defluidization. Carbon deposition was rapid above 395 C when a feed gas of H_2/CO ratio of 2:1 or less was used. Cold-flow microreactor model studies show that rapid (on the order of seconds), quantitative switching of feed gases over a vibrofluidized bed of catalyst could be achieved. Vibrofluidization of the catalyst bed induced little backmixing of feed gas over the investigated flow-rate range of 417 to 1650 actual mm^3/s. Further, cold-flow microreactor model studies showed intense solid mixing when a bed of fused-iron catalyst (150 to 300 microns) was vibrofluidized at 24 cycles per second with a peak-to-peak amplitude of 4 mm. The development of the microreactor systems provided an easy way of accurately determining integral fluid-bed kinetics in a laboratory reactor. 408 refs., 156 figs., 27 tabs.

13030 **(DOE/PC/70042—T6) Research of coal liquefaction co-processing: Quarterly technical progress summary report, October-December 1986.** (Lummus Crest, Inc., Bloomfield, NJ (USA)). 1986. Contract AC22-84PC70042. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004215.

A brief campaign was carried out in the close-coupled LC-FINER to produce hydrogenated Arab Heavy resid at mild hydrocracking conditions. This test was carried out with a high catalyst

loading and at conditions to result in a nominal 40% conversion of 975F+. The Hydrogen Uptake Index, i.e., the relative percent change in the hydrogen/carbon atomic ratio of the virgin resid(VR) as compared to that of the hydrotreated resid(HR), or (H/sub HR/C/sub VR//C/sub HR/H/sub VR/-1) x 100%, was +7.6. This value is the highest obtained for the existing database with Arab Heavy resid. The positive sign indicates that the hydrotreated resid has a higher hydrogen content than that of the virgin resid. At high hydrocracking severities, however, the Hydrogen Uptake Index can be negative, i.e., the hydrogen content of the hydrotreated resid is less than that of the virgin resid. A future coprocessing bench-scale test will evaluate the ability of this mildly hydrotreated resid solvent to achieve high SCT coal conversions while simultaneously minimizing SCT preasphaltenes make. LC-Finate distillate cuts from two co-processing tests made with McElroy coal (CTS-7 and 12) were recovered and assayed for petroleum type properties. The resultant data are presented in Tables Q9-3,4,5 and 6 as a function of nominal boiling range: C_5-400F for the naphtha cut; 400 to 600F for the middle distillate cut; 600 to 975F for the heavy gas oil cut; and 975F+ for the co-processed vac resid cut. For information purposes, the analyses of representative hydrocrackates when processing coal only (short contact time ITSL Process) and petroleum only (LC-FINING) are also presented in the tables. 6 tabs.

13031 **(DOE/PC/70801—T9) Thermodynamic properties for supercritical coal conversion: Quarterly progress report, 10/1/86-12/31/86.** Eckert, C.A. (Illinois Univ., Urbana (USA). Dept. of Chemical Engineering). 1986. Contract FG22-84PC70801. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004498.

This quarter we completed several runs on the medium temperature solubility apparatus with supercritical butane and dodecahydrotriphenylene. The high temperature solubility apparatus is a relatively new unit capable of running solvents to temperatures of 350°C. Several sets of consistent data were obtained for dihydrodibenzophenazine in supercritical ethanol with this apparatus. An isotherm at 275°C is shown in Figure 1. High temperature supercritical solvents like butane and ethanol show significant potential for coal processing applications. Experiments with a variety of solvents, solutes, and entrainers will aid in the development of a better understanding of supercritical fluid phase behavior. Construction of the new solubility apparatus is complete and initial testing is in progress. Physical construction of the fluorescence spectroscopy apparatus is complete. Adjustment and testing are in progress. 1 fig.

13032 **(DOE/PC/80502—T3) Interactive chemistry of coal-petroleum processing: Progress report, June 16, 1986 to September 15, 1986.** Curtis, C.W.; Guin, J.A.; Tarrer, A.R. (Auburn Univ., AL (USA). Coal Conversion Lab.). 1986. Contract FG22-85PC80502. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004013.

The objective is to investigate the interactive thermal and catalytic chemistry of coal-petroleum processing using model compounds and actual petroleum-coal materials. The work performed during this quarter has focused upon (1) a review of proposed coal liquefaction mechanism and the impact of using petroleum derived solvents on those mechanisms; (2) the preparation of a paper entitled "An Examination of the Role of Hydrogen Donation in Coprocessing" for presentation at the Fall National AIChE Meeting in Miami; (3) an examination of the trace metals in coal and petroleum residua to be used as a basis for performing objective 2; and (4) experimental work continued using naphthalene and hexadecane to train graduate research assistants in experimental methodology. Contents of this report include: Part I: a review of proposed coal liquefaction mechanisms; Part II: an examination of the role of hydrogen donation in coprocessing; and Part III: an examination of trace metals in petroleum residua and preliminary experimental results. 71 refs., 20 tabs.

13033 **(DOE/PC/80507—T5) Catalytic coal gasification: Identification of active sites, October 15, 1986-January 14, 1987.** Falconer, J.L.; Lauderback, L.L. (Colorado Univ., Boulder (USA)). 20 Jan 1987. Contract FG22-85PC80507. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004238.

This research uses transient isotope tracing, at steady-state reaction conditions, in combination with surface analysis techniques (secondary ion mass spectrometry (SIMS) and x-ray photoelectron spectroscopy (XPS)). Carbon dioxide gasification of carbon blacks and coal char will be used initially, since this appears to be rate-determining during steam gasification; steam gasification will be used in later experiments. In a typical isotope tracing experiment, $^{12}CO_2$ flow over a carbon-catalyst mixture will be quickly replaced by $^{13}CO_2$ at the same pressure and flow rate. The changes in the concentrations of ^{12}CO and ^{13}CO products, and in the $^{12}CO_2$ and $^{13}CO_2$ concentrations, as a function of time, will be measured with a computer-controlled mass spectrometer. The use of isotope transients allows the concentration of active catalytic sites to be measured directly at reaction conditions and it allows the rate constant to be measured. Isotope tracing will be carried out as a function of reaction temperature, catalyst loading, catalyst type and carbon conversion. Surface analysis techniques will be used to determine the active forms of the catalysts. Model studies of catalyst-carbon interactions will also be carried out with SIMS in order to determine the form of surface species. The combination of isotope tracing and surface analysis will elucidate the details of the reaction mechanism. This insight into the mechanism of coal gasification will help in improving process kinetics for gasification.

13034 **(DOE/PC/80907—T4) Reactivity of coal in direct hydrogenation processes: Technical progress report, September-November 1986.** Baldwin, R.M.; Miller, R.L. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). Jan 1987. Contract FG22-85PC80907. 16p. NTIS, PC A02. File Number DE87003999.

Research during the past quarter has centered on two separate projects related to this program. First, the methodology and calculational procedures required to apply the Anthony-Howard non-isothermal distribution of activation energies technique to our coal liquefaction data was developed fully. A PC-based computer program was written which permits estimation of the A-H fitting parameters for mean activation energy, the distribution function, and preexponential factor. In general, the Anthony-Howard model was found to be superior to other kinetic models examined. A second project was started during the past quarter which was intended to re-examine one of the basic assumptions under which the program was being carried out. During the recent Principal Investigator's conference in Pittsburgh, several concerns were raised relative to solvent effects on the data and ultimate reactivity rankings being determined. The effect of solvent on relative reactivity measurements was re-examined focusing on liquefaction reactions of three coals of different ranks in 7 different solvents (1-methylnaphthalene, naphthalene, phenanthrene, water, dodecane, tetralin, and a blank). An ancillary study on hydrogenation of benzophenone in 6 different vehicles under hydrogen and helium gas atmospheres was also completed in order to examine hydrogen transfer and shuttling mechanisms under the same conditions being employed in the liquefaction experiments. The results of these studies prove conclusively that: (1) under the reaction conditions being used in this program, the vehicle (solvent) employed in determining the relative reactivity rankings within a group of coals has no effect on the resultant reactivity ranking and; (2) 1-methylnaphthalene is not acting as a hydrogen donor under conditions being employed for measurement of liquefaction reactivity data. 4 refs., 4 tabs.

13035 **(DOE/PC/80908—2) Low severity coal conversion by ionic hydrogenation: Report for the period October 1 to December 31, 1986.** Cheng, J.C.; Larsen, J.W. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). 16 Jan 1987. Contract FG22-85PC80908. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004117.

The objectives are: to explore the ionic hydrogenation of low rank coals using H_2O:BF_3 as the acid and hydrogen gas as hydrogen donor in the presence of catalytic quantity of transition metal complex; to develop favorable reaction conditions under which only carbon-heteroatom linkages of coals are cleaved. During this quarter, more experiments were performed for ionic hydrogenation of triphenylmethanol in search for mild reaction conditions and proper proton and hydride donor systems. Table I shows a series of reaction results using trifluoroacetic acid as reaction medium. With 4.2 mol % of platinum complex as catalyst the

yields moved from quantitative to moderate as hydrogen pressure and reaction time were reduced. The same trend was observed with somewhat lower yields when 1 mol % of the platinum complex was used and that comparable yields were achieved using less platinum complex but longer reaction times. Effect of acids on ionic hydrogenation of triphenylmethanol was studied using BF_3:H_2O, BF_3:MeOH, triflic acid, and p-toluenesulfonic acid in addition to trifluoroacetic acid. Results are discussed. Ionic hydrogenation of 1-methoxynaphthalene and 1-tetralone were also studied. Both materials were less reactive than triphenylmethanol. 8 refs., 3 tabs.

13036 **(DOE/PC/81208—T1) Microbially augmented ash and pyrite physical separation (MAAPPS): Quarterly report, September 1, 1986-November 30, 1986.** (Atlantic Research Corp., Alexandria, VA (USA)). Dec 1986. Contract AC22-85PC81208. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003882.

The overall objective of this research is to optimize the MAAPPS process to clean finely ground coal to ≦ 1% ash and ≦ 0.5% pyritic sulfur. The MAAPPS process uses a microbial surfactant which selectively increases the hydrophilicity of ash and pyrite, thereby enhancing separation and removal of these contaminants during flotation. In experiment No. 3, good cleaning of the coal was achieved without pretreatment of the coal. Sulfur and ash levels were generally equivalent to those obtained following pretreatment in experiment No. 2. Results of experiment No. 4 confirm the results obtained in experiment No. 2. Significant decreases in sulfur and ash were noted when the coal was pretreated with the "cell-free" media. Yields were good, with Btu recoveries near 80%, with pyritic sulfur decreases of about 60%, and with ash reduction of 67%. Results of these experiments are preliminary and do not represent optimized conditions for ash and sulfur removal. The lack of enhanced rejection of ash and sulfur in coal pretreated with concentrated microrganisms could be the direct result of bacterial stress or injury during concentration or, more likely, the result of separating the microbial surfactant from the biomass. The enhanced rejection of ash and pyrite following treatment with the surfactant (no microbes) indicates that this surfactant may be the active material producing the desired MAAPPS effect during flotation. 10 tabs.

13037 **(DOE/PC/90521—T1) Role of porosity in supercritical fluid extraction of coal: Technical progress report.** Bale, H.D. (North Dakota Univ., Grand Forks (USA). Dept. of Physics). 20 Jan 1987. Contract FG22-86PC90521. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004480.

This report covers studies on small angle scattering and Fourier transform infrared spectroscopy. Small angle x-ray scattering from a coal sample under supercritical conditions presents a new and challenging instrumentation problem. Although the present DOE contract support of this project began less than four months ago, we have during the past two years been developing the instrumentation necessary for in situ scattering experiments at elevated temperature and pressure. Our system is now essentially complete and we are currently testing the system. In this report we briefly describe three components of the system and discuss some of the tests and correction programs that we have developed. Methods were examined for the on-line qualitative and quantitative analysis of the material extracted from the coals with supercritical solvents under flow-through conditions. The objective is to interface a highly specific detection system such as Fourier transform infrared spectroscopy (FTIR) to the extraction cell where x-ray scattering is being carried out so that information on the rates of evolution of different types of organic species can be determined. 4 figs.

13038 **(DOE/PC/90533—1) Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report for period September 15, 1986 to December 15, 1986.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 7 Jan 1987. Contract FG22-86PC90533. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004326.

During the first quarter significant progress was made in the design and construction of a computer-automated reactor system to be used in the kinetic and deactivation studies. A portion of the computer software was written while most of the equipment and supplies for fabrication of the system were ordered and received. A study of literature dealing with deactivation of catalysts by carbon was conducted. Two graduate students were hired to construct the reactor and conduct kinetic/deactivation experiments. The PI attended the Anaheim ACS meeting and received one visitor. 44 refs., 1 fig.

13039 **(EPRI-AP—4995-Vol.1) Chemical structure and liquefaction reactivity of coal: Volume 1, Chemical-structural characteristics and reactivity of low-rank coals: Final report.** Chung, K.E.; Goldberg, I.B.; Ratto, J.J. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 89p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920187.

A Wyoming subbituminous coal and a Texas lignite were characterized in terms of the distribution and arrangement of oxygen functional groups, aromatic clusters and linkages and side chains of the clusters. The structural data were related to the hydroliquefaction behavior of the coals such as potential products, their distribution, and hydrogen consumption. The characterization consisted of controlled solubilization of each coal with NaOH/ethanol/H_2O, solvent fractionation and detailed product analysis. The role of the solubilization reaction was studied by using deuterated reagents and model compounds. In addition, hydroliquefaction reactivity of the Wyoming coal was examined with two solvents, tetrahydroquinoline (THQ), and a mixture of tetralin and pyrene. At 300°C, THQ reacted and combined with the coal to form inseparable coal-THQ complexes or compounds, while donating little hydrogen to the total product. The reaction of the coal with a mixture of tetralin and pyrene under H_2 pressure showed that strong linkages between aromatic clusters were cleaved extensively at 400°C and one hour of reaction time. Due to insufficient hydrogen donatability of the solvent, the liberated clusters recombined to become a nondistillable product. At 454°C, in addition to the cleavage of the linkages, dealkylation was a dominant reaction as indicated by a 2.8-fold increase in gaseous product yield over that at 400°C, and a high carbon aromaticity of a nondistillable product fraction. 21 refs., 35 figs., 34 tabs.

13040 **(EPRI-AP—4995-Vol.2) Chemical structure and liquefaction reactivity of coal: Volume 2, Moderate-temperature coal liquefaction: Final report.** Skowronski, R.P.; Heredy, L.A. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 49p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920188.

Coal hydrogenation experiments were conducted at 325°C and 3000 psi H_2 pressure. It was postulated that at this lower operating temperature most selective bond cleavage reactions will occur, promoting an efficient use of hydrogen and helping the identification of different hydrogenation and hydrocracking reactions. No donor solvent was used to simplify the analysis of the liquid products. Both catalytic and noncatalytic reactions were investigated. The following conclusions were reached: using a Pittsburgh seam coal (C = 82%), it was shown that the liner and impeller of the autoclave had a strong catalytic effect on the liquefaction reaction. The oil yield was 48% when the metallic surface was exposed and only 19% when these parts were replaced with a glass-coated liner and impeller; (2) catalysis by nickel (applied as nickel acetate impregnated into the coal) gave significantly different results from those obtained when the uncoated liner and impeller catalyzed the reaction. Overall conversion to soluble products was higher using the nickel catalyst (94 versus 87%). However, nickel catalysis gave lower conversion to oil (40 versus 48%). The oil produced in the nickel-catalyzed hydrogenation was significantly more aliphatic in character (the aliphatic to aromatic ratio was 83/17 as compared with 74/26); (3) comparing these tests with those made earlier with a lower rank coal (C = 80%), it was found that the latter was much more reactive and gave 50% higher oil yield than the higher rank coal (C = 82%). The oil yields were 72 and 48%, respectively. 4 refs., 14 figs., 6 tabs.

13041 **(EPRI-AP—5004) Carbon conversion-ash agglomeration study for the KILnGAS coal gasification process: Final report.** (Allis-Chalmers Corp., Milwaukee, WI (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 70p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920189.

A study of carbon conversion/ash agglomeration in the KILnGAS coal gasification process was conducted jointly by the Allis-Chalmers Corporation and Southern Illinois University-Carbondale. This study, funded by the Electric Power Research Institute was conducted for the purpose of understanding a phenomenon at the KILnGAS Commercial Module (KCM) where ash inside the gasifier agglomerates into large balls, which caused plant operating constraints. This condition was experienced when the process was operating at a level required to achieve design rated carbon conversion. A laboratory-scale ported rotary gasification reactor was built which had the capability to simulate KCM process operating conditions. Gasification tests were run in this reactor with two coals, Illinois No. 6 and Colorado Wadge, to investigate the process conditions which promote agglomeration of ash. It was subsequently determined that the formation of large ash agglomerates can be attributed to high peak bed temperature caused by excessively high air-to-steam (A:S) ratios. It has, therefore, been concluded that the A:S ratio should be used as a primary control parameter in the KCM process operation for limiting peak bed temperature and, in turn, controlling the growth of ash agglomerates. 7 refs., 20 figs., 14 tabs.

13042 **(EPRI-AP—5005) Pyrolysis of coal for production of low-sulfur fuel: Final report.** Alvin, M.A.; Archer, D.H.; Ahmed, M.M. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Systems Div.; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 210p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920190.

Various sulfur control strategies have been developed to meet existing federal regulations and potential future legislation. These include coal washing (physical cleaning), switching to low-sulfur coal, fluidized-bed combustion, coal gasification combined cycle, and flue gas desulfurization. A fluidized-bed pyrolysis approach which selectively releases specific sulfur species while maintaining a significant portion of the heating value of the feed coal in the product char has been demonstrated on a laboratory scale at Westinghouse. This approach utilizes an alternate gas contacting sequence. The sequencing concept is based on a series of chemical reactions and transformations which are expected to occur within the organic and ash matrices of the coal. This report is a summary of three projects conducted at Westinghouse which identified process conditions that produce low sulfur char from Illinois No. 6 and Wyoming subbituminous coals. The paper in the appendix, "Generation of Reduced Sulfur Char by Coal Partial Pyrolysis/Gasification," has been processed separately for inclusion in the Energy Data Base. 2 refs., 7 figs., 17 tabs.

13043 (EPRI-AP—5005, pp 126, Appendix A) **Generation of reduced sulfur char by coal partial pyrolysis/gasification.** Alvin, M.A.; Newby, R.A.; Archer, D.H.; Ahmed, M.M.; Parker, D.W.; Keairns, D.L. Jan 1987. Research Report Center, Box 50490, Palo Alto, CA 94303. File Number TI87920190.

In Pyrolysis of coal for production of low-sulfur fuel: Final report.

Electric utilities have interest in obtaining a low cost, low sulfur, coal-derived solid fuel for conventional steam boilers. This study was concerned with the production of a low sulfur char under specific pyrolysis, hydropyrolysis, gasification or oxidation conditions at various temperatures (400 to 800°C), pressures (1 and 10 atm) and gas contacting times, while maintaining a high heating value in the char product. Forty-five bench-scale, fixed-bed tests were conducted to demonstrate the feasibility of the gas sequencing approach in the desulfurization of -20 +40 mesh Illinois No. 6 coal. The maximum desulfurization achieved was 50 to 60% removal of the initial sulfur content. Data on the sulfur distribution in the resulting char indicated that the removal of pyritic sulfur is easily achieved under most pyrolysis conditions, however, the difficulty lies with the release of organic sulfur. Steam was demonstrated as the only contacting gas which effectively released organic sulfur. Continued effort is required to identify the ultimate gas contacting sequence and reaction conditions which maximize coal desulfurization and maintain a high heating value of the char product. Additional studies are essential to more fully understand the sulfur release reactions and mechanisms. 72 refs., 20 figs., 33 tabs.

13044 **(EUR—9280) To investigate methods of recovery, treatment and utilization of solids-bearing effluents emanating from coke ovens.** (Commission of the European Communities, Luxembourg). 1984. 46p. Commission of the European Communities, Luxembourg.

This paper describes techniques tested at the BCRA large-scale test plant for the collection measurement and recovery of solids, individually and as mixtures, from the preheater wet scrubber and the oven charging-main. Because steam bleed-off solids were found to be virtually unaffected coal of relatively coarse grading, it was considered unnecessary to evaluate methods of recovery of carryover from this source.

13045 **(EUR—10588-DE-EN-FR) Round-table meeting 'chemical and physical valorization of coal'.** (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1986. 185p. (In German, English and French). (CONF-8512113—). Commission of the European Communities, Brussels, Belgium.

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

The round table discussed the results of research in the field of coal science that forms part of the European Coal and Steel Community's technical coal research programme. The meeting covered the characterization of coal and coal products by petrographic and chemical methods. Papers on hydropyrolysis and the behaviour of binders in the preparation of coke and electrodes were also presented. All papers are abstracted separately.

13046 (EUR—10588-DE-EN-FR, pp 1-23) **On the hydrogenation characteristics of coal FBC extracts.** Meier zu Koecker, H.; Mueller, G.; Noack, R.; Schmelter, W.; Taetz, F. (University of Berlin (Germany, F.R.). Institute of Chemical Engineering). 1986. (In German). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

The concept of two-stage coal liquefaction incorporating fluidised bed extraction as a first stage requires an understanding of the hydrogenation characteristics of the fluidised bed extracts. In a series of exhaustive investigations lasting several years, non-continuous autoclave tests were carried out into the hydrogenation of various extracts of bituminous and brown coals under varying operating conditions both with and without a catalyst. The extracts were mashed for hydrogenation with the middle distillate of a coal oil, obtained by direct hydrogenation, in the ratio 1 to 2. The catalysts used were red mud and both sulphurated and unsulphurated CoMo and NiMo contacts. The report deals with the findings from the bituminous coal extract hydrogenation tests, the functional relationships between the quantitative yield of fluid hydrogenation products and the qualitative product composition, on one hand, and the varying degrees of catalytic activity on the other. The products of hydrogenation are defined by capillary gas chromatography, IR spectroscopy and HPLC. Finally, the hydrogenation results are presented as obtained with simultaneous partial heavy-oil recycling. 6 refs.

13047 (EUR—10588-DE-EN-FR, pp 67-91) **Effects of pressure and of the reactive medium on benzothiophene pyrolysis.** Cypres, R.; Bettens, B.; Hermans, C. (Universite Libre de Bruxelles (Belgium). Service de Chimie Generale et Carbochimie). 1986. (In French). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

The present work deals with the decomposition of benzothiophene at 875 C in a dynamic system as a function of the nature of the carrier gas (H_2 or N_2) and the pressure (0.1 to 2 MPa). Specific

marking by carbon 14 of the benzothiophene has made it possible to determine the effect of the above factors on its pyrolysis mechanism. The primary rupture mechanism consists of rupture between the carbon of the benzene cycle and the sulphur atom and mainly produces H_2S and products of condensation. Hydrogen increases the degradation of the molecule and causes rapid saturation of the double bond of the heterocycle, giving rise to a freer rupture of the C-C and C-S bonds of the heterocycle, with CH_4 formation, increased stabilisation of the aromatic nucleus with formation of benzene and progressive elimination of the condensation compounds. The effects of pressure are observed by the disappearance of the sulphurated gases of the gas phase; the sulphur basically re-emerges at solid-phase level. 14 refs.

13048 (EUR—10588-DE-EN-FR, pp 93-105) **Continuous potentiometric determination of hydrogen sulphide emission for investigating the in-situ sulfidation of molybdenum in impregnated coal.** Laudet, A.; Vidick, B.; Derbyshire, F.J. (Universite Libre de Bruxelles (Belgium). Service de Carbochimie). 1986. (In French). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

A silver sulphide electrode has been modified for the continuous potentiometric determination of hydrogen sulphide emission in order to study the in-situ sulphidation of coal samples impregnated with a molybdenum salt, an element whose most active catalytic form from the point of view of coal liquefaction is MoS_2. It was also demonstrated that the molybdenum, introduced in the form of ammonium heptamolybdate, could be sulphided by H_2S obtained by pyrite reduction (initially present or added to the impregnated coal), under the conditions of sample pre-treatment before liquefaction, i.e. at 400 C and in a hydrogen atmosphere. It was also noted that the yield from the sulphidation reaction is higher when the sample, after impregnation, is lyophilised rather than dried at 120 C in a vacuum, a factor which is attributed to the improved state of dispersion of the molybdenum. 6 refs.

13049 (EUR—10588-DE-EN-FR, pp 107-125) **Changes in the structure of semi-coke and in the gas characteristics during the hydrogenated gasification of coal.** Cypres, R.; Braekman-Danheux, C.; Planchon, D. (Universite Libre de Bruxelles (Belgium). Service de Chimie Generale et Carbochimie). 1986. (In French). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

The gaseous products formed during the hydrogenated pyrolysis of coal were analyzed by gas chromatography coupled directly to the high-pressure thermobalance. In all cases, in an inert or hydrogen atmosphere, the order of appearance observed was as follows: CO_2, CO and CH_4. An increase in hydrogen pressure promotes the formation of methane and ethane and inhibits that of the oxygenated and unsaturated components. The emission of volatile matter other than methane indicates that up to 750 C the tars are not completely liberated. It was possible to show that the major formation of methane during the devolatization phase at 4 MPa hydrogen pressure which follows a period of coal precarbonisation in an inert atmosphere was basically due to the rapid gasification of carbon from active sites left vacant by pre-carbonisation. Changes in the elementary composition of the semi-coke during hydrogenated gasification were also determined and proved to be dependent exclusively on the gasification rate and not on the hydrogen-pyrolysis conditions which brought them about. 7 refs.

13050 (EUR—10588-DE-EN-FR, pp 127-142) **Hydropyrolysis of Spanish lignite.** Cypres, R.; Moliner, R. (Universite Libre de Bruxelles (Belgium). Service de Chimie Generale et Carbochimie). 1986. (In French). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

Hydropyrolysis of a sample of lignite from the Teruel coalfield (Spain) was carried out at between 380 and 850 C and at pressures of between 0.1 and 3 MPa. The yield of light aromatic hydrocarbons and light phenols is much greater under hydrogen pressure than in the presence of helium. Optimum yields were obtained at relatively low temperatures (approx. 525 C) at a hydrogen pressure of 3 MPa. Differential thermal analysis under pressure and thermogravimetry under pressure both revealed the importance of hydrogen in the thermal make-up and kinetics of the reaction process. 7 refs.

13051 (EUR—10588-DE-EN-FR, pp 167-181) **Direct conversion of coal to chemical feedstocks: two-stage catalytic hydropyrolysis of coal.** Snape, C.E.; Martin, T.G. (National Coal Board, Cheltenham (United Kingdom). Coal Research Establishment). 1986. Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

Two-stage catalytic hydropyrolysis, in which primary tar vapours from a fixed bed of coal are passed directly over a hydrocracking catalyst, is being investigated as a route for the direct conversion of coals to low boiling products. In the first stage, high tar yields (about 30% daf coal) have been obtained from a low rank UK coal under relatively mild conditions (500 C and 150 bar H_2 pressure). The use of a commercial Ni/Mo hydrotreating catalyst in the second stage at 400 C results in the tars being converted to aliphatic oils with up to 50% boiling below 200 C. Increasing the hydropyrolysis temperature from 500 to 600 C gives higher distillate yields but methane yields increased considerably (from $<$ 5 to 10%) and the distillates are more aromatic. Operation at higher pressures ($>$ 200 bar) is beneficial in that higher primary tar yields have been obtained and the tars remain amenable to hydroconversion. Unlike the Ni/Mo catalyst, zeolites have been found to be unsuitable for upgrading the primary tars. 9 refs.

13052 (NERDDP-EG—84-329) **New Fischer Tropsch catalysts.** Baker, B.G.; Clark, N.J. (Flinders Univ. of South Australia, Bedford Park. Inst. for Energy Studies). 1983. vp. Department of Resources and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

The objective of this project is to develop methods of producing liquid hydrocarbon fuels of improved composition by the Fischer-Tropsch reaction. The reactants, carbon monoxide and hydrogen, may be obtained by gasification of coal or char or by steam reforming natural gas. Improvement of existing Fischer-Tropsch technology is sought by developing catalysts of greater selectivity. Laboratory scale tests of new catalyst preparation have resulted in the development of two prototype catalysts of potential practical importance.

13053 (NP—7770057) **Gas and coke formation in coal pyrolysis under pressure in an inert, reducing or oxidizing atmosphere.** Fischer, B. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 5 Jul 1985. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87770057.

In the temperature range of pyrolysis, the influence of pressure on gas formation was determined, and the resulting semi-coke was characterized and analyzed. Pressure pyrolysis was carried out not only in inert conditions similar to those of coking under pressure, but also in a reducing and oxidizing atmosphere. H/sub 2/, H/sub 2/O, CO/sub 2/, and CO were used for flushing, and their effect on the pyrolysis reactions was determined. A comparison with literature data was to show if microscale data can be extrapolated to industrial-scale facilities. For this purpose, a semi-industrial experimental facility with a fixed-bed reactor was constructed which permitted time-linear, allothermic heating of 500 g coal at pressures up to 80 bar and temperatures up to 1200 K with a continuous flow of preheated flushing gas.

13054 (ORNL/SGMP—86/2) **Surface Gasification Materials Program: Semiannual progress report for the period ending September 30, 1986.** (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). Jan 1987. Contract AC05-84OR21400;W-31-109-ENG-38. 59p. NTIS, PC A04/MF A01. File Number DE87005296.

The objective of the Surface Gasification Materials Program is to conduct research and development on materials for application

to the specific needs of coal gasification systems. One of the goals of the program is to evaluate innovative fabrication methods which have the potential to lower costs and improve reliability and safety for gasifier vessels and components. Another goal is to conduct engineering-scale development and application of materials for coal gasification systems to ensure that the materials of construction for pilot plants and future large-scale plants can be properly selected and specified. This semiannual progress report covers: (1) protective coatings and claddings - application/evaluation; (2) electroslag component casting; (3) materials development for solid oxide oxygen production unit; and (4) development of iron aluminides.

13055 **(PB—87-115275/XAB) Thermally initiated carbon-carbon bond cleavage reactions occurring during coal gasification. Annual report, April 1985-March 1986.** Zabransky, R.F.; Stock, L.M. (Institute of Gas Technology, Chicago, IL (USA)). May 1986. 43p. NTIS, PC A03/MF A01.

Samples of Illinois No. 6 coal were modified by the incorporation of 5-(1,2,3,4-tetrahydronaphthyl)-methyl, 6-(1,2,3,4-tetrahydronapthyl)methyl, 5-(1,2,3,4 tetrahydronapthyl-1,1,4,4-d4)methyl and 6-(1,2,3,4-tetrahydronapthyl-1,1,4,4-d4)methyl as 0-alkyl substituents. These samples were then pyrolyzed in a helium atmosphere over a temperature range of 690-850 C using a heated wire-screen reactor. The gaseous products were analyzed by gas chromatography-mass spectrometry. Comparison of the yields and isotope distributions in the methane, ethane, ethene, propane and propane pyrolysis products show deviations from the predictions of random scrambling of deuterium and hydrogen atoms. There was noticeable change in the ratio of different deuterated products obtained from pyrolysis at 690 and 832 C, which suggests that the inherent characteristics of the reactions change with increasing temperature.

13056 **(PB—87-120077/XAB) Program to discover materials suitable for service under hostile conditions obtaining in equipment for the gasification of coal and other solid fuels. Phase 1. High temperature corrosion. Annual report, January-December 1985.** Verma, S.K.; Schaefer, A.O. (Materials Properties Council, Inc., New York (USA)). 15 Aug 1986. 72p. NTIS, PC A04/MF A01.

The Annual Report of the Phase I program begins with consideration of the results of test runs 64 to 67 conducted on equipment at IITRI under contract with MPC. To assess materials behavior in the direct-methanation-effluent environment of Westinghouse and Lurgi, four new tests (Runs 64-67) were initiated in 1984 at 1200°F. These test coupons (Runs 64 and 66) and weldments (Runs 65 and 67) completed 10,000 hours exposure in 1985. A number of alloys and weldments suitable for direct methanation effluents were identified.

13057 **(PB—87-120093/XAB) Engineering support services for the DOE/GRI (Department of Energy/Gas Research Institute) coal-gasification research program. Quarterly report, April-June 1986. Interim report.** Mazzella, G.; Fu, R.K. (Foster Wheeler USA Corp., Livingston, NJ). Jul 1986. 41p. (FW—21-3035-3). NTIS, PC A03/MF A01.

Technical support services for the DOE/GRI Joint Program includes monitoring and evaluation of research activities related to coal gasification sponsored under the Joint Program. The report summarizes Foster Wheeler's support services during the April-June 1986 period. Project-monitoring activities were continued on the KRW fluidized-bed gasifier PDU, the IGT high pressure fluidized-bed gasifier PRU, and the CNG acid-gas-removal process. In addition, a conceptual design and cost study was completed for commercial-scale-acid gas removal units based on the CNG technology.

13058 **(PB—87-120994/XAB) Engineering support services for the DOE/GRI (Department of Energy/Gas Research Institute) coal gasification research program. Quarterly report, January-March 1986. Interim report.** Mazzella, G.; Fu, R.K. (Foster Wheeler USA Corp., Livingston, NJ). Apr 1986. 44p. (FW—21-3035-2). NTIS, PC A03/MF A01.

Technical support services for the DOE/GRI Joint Program includes monitoring and evaluation of research activities related to coal gasification which are sponsored under the Joint Program. The report summarizes Foster Wheeler's support services during the January - March 1986 period. Project monitoring activities were continued on the KRW fluidized bed gasifier PDU, the IGT high pressure fluidized-bed gasifier PRU, and the CNG acid gas removal process. In addition, a conceptual design and cost study was started for commercial scale acid gas removal units based on the CNG technology.

13059 **(PB—87-141032/XAB) In-process control of nitrogen and sulfur in entrained-bed gasifers. Final report.** Adams, R.C.; Aul, E.F.; Kulkarni, S.; McAllister, R.A.; Margerum, S. (Radian Corp., Research Triangle Park, NC (USA)). Dec 1986. 197p. (DCN—86-203-023-57-08). NTIS, PC A09/MF A01.

The report gives results of an evaluation of theoretical aspects and engineering considerations of in-process pollutant control of the entrained-bed slagging coal-gasification process, as applied to combined-cycle operation or to the retrofit of existing boilers. The pollutants of concern are the nitrogen and sulfur oxides (NOx and SOx) which, without controls, are products of combustion of the gasifier product gas. A literature search and theoretical evlauation were conducted to identify the chemical/physical conditions and flow characteristics of entrained-bed slagging gasification as they relate to in-process control of NOx and SOx precursors. However, the degree of success of the suggested in-process controls could not be projected. The applicability of potential in-process control was examined. It was concluded that in-process controls, if feasible, are applicable for reducing NOx and SOx precursors so that the capacities of downstream control devices can be reduced with subsequent cost savings.

13060 **(SAND—86-1837C) Impact of nitrogen compounds on catalyst activity.** Stohl, F.V. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 8p. (CONF-8610220—1). NTIS, PC A02/MF A01. File Number DE87001731.

From DOE contractors meeting; Pittsburgh, PA, USA (21 Oct 1986).

Second stage coal liquefaction catalysts lose greater than 75% of their hydrogenation activity as soon as coal processing begins. This rapid deactivation is due to the buildup of carbonaceous deposits on the catalyst. The objective of the research presented in this paper, which is part of a larger study aimed at extending catalyst life by mitigating the effects of carbonaceous deposits, is to identify the hydrotreater feed components that are responsible for the greatest deactivation. Previous studies at Sandia to determine the effects on catalyst activity of various chemical classes of compounds found in hydrotreater feed have shown that the nitrogen polycyclic aromatic compounds cause the greatest deactivation (95% loss of hydrogenation activity), but the effect of the hydroxy polycyclic hydrocarbons (81% loss) is also important. Research is therefore being carried out to identify the properties of nitrogen and hydroxy compounds responsible for this deactivation. Nitrogen model compounds with different properties have been hydrotreated with presulfided Shell 324M catalyst. Hydrogenation activity testing of the aged catalysts from these runs has shown that the greatest deactivation is due to quinoline and the least deactivation is due to carbazole. Both a 5 minute run and a 2 hour run with quinoline at 400°C caused about 80% losses of hydrogenation activity, whereas hydrotreating carbazole for 2 hours only caused a 48% loss. The greater deactivation due to hydrotreating quinoline is probably due to the basicity of this compound. Results of studies on other nitrogen compounds with different properties and on hydroxy compounds are also discussed. 10 refs., 4 tabs.

13061 **Hot gas clean-up: zinc ferrite leads the way.** Day, L.M. (Morgantown Energy Technology Center, WV). *Modern Power Systems;* **6**: No. 11, 71, 73, 75(Nov 1986).

Removing sulphur from a hot gas stream will significantly improve the economics of coal gasification for power generation. The US Department of Energy is funding development of the use of zinc ferrite ($ZnFe_2O_4$) as the absorbent. Pilot scale tests will be performed soon.

13062 **Bituminous coal underground coal gasification - potential and needs.** Burwell, E.L. (US Dept. of Energy, Washington, DC (USA)). pp 13-20 of Proceedings of the Illinois Mining Institute. Ninety-third year 1985. Champaign, IL; Illinois Mining Institute (1985). (CONF-8510397—).

From 93. annual meeting of Illinois Mining Institute; Springfield, IL, USA (31 Oct 1985).

Underground coal gasification is potentially applicable to 9.2 billion tons of bituminous coals in the Illinois Basin and surrounding areas. A logically planned development program is underway through the cooperative venture. Successful development of UCG could have a tremendous positive effect on the economy of the Illinois Basin and surrounding area. Optimal progress toward development will only occur through the cooperative efforts of DOE, Peabody Coal Company, the State of Illinois, academia, and other related groups. Government should not attempt to force UCG technology into commercial application before the marketplace is ready. Government's role should be to complement the initiatives of the industry, providing a sound base of technology from which commercially promising concepts can emerge and be successfully deployed.

0105 By-products

REFER ALSO TO CITATION(S) 13082, 13175, 13205, 13206, 13207

0106 Properties

REFER ALSO TO CITATION(S) 13015, 13018, 13030, 13037, 13041, 13045, 13136, 13844, 13855, 13979

13063 **(CONF-860425—39) The application of inverse gas chromatography to coals and oxidized coals.** Neill, P.H.; Winans, R.E. (Argonne National Lab., IL (USA)). 1986. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004954.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

This paper covers the application of Inverse Gas Chromatography to coals of various ranks and degrees of air oxidation. The objective of this study is to provide detailed information on possible changes in the chemical and physical structures of the Argonne Premium Coal Samples during storage. While it is known that subtle changes in the physical and chemical structure of bituminous coals can effect changes in the plasticity upon heating, the techniques traditionally used to measure plasticity do not yield information which can be used to understand these changes. A new approach, inverse gas chromatography (IGC), a technique widely used for studying polymers, is being used to study phase transitions in coals upon heating. Inverse GC has been applied to polymers to measure the glass transition temperature, the degree of crystallinity, melting point, thermodynamics of solution, and chemical composition. In contrast to classical GC, inverse chromatography probes the stationary phase, a coal, by determining the retention time of known compounds on it. This transposition of known and unknown in the GC experiment gives rise to the term "inverse chromatography". The coal samples will be chosen to examine variations with rank and to investigate structural changes in ground coals, both in air and in the absence of air, as a function of time. These approaches show promise for providing chemical information on subtle variations in coal structure. 4 refs., 2 figs., 2 tabs.

13064 **(CONF-870323—1) Phase equilibria of continuous fossil fuel process oils.** Abbasian, M.J.; Weil, S.A. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 37p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900456.

From American Institute of Chemical Engineers spring national meeting; Houston, TX, USA (29 Mar 1987).

Fossil fuel process oils consist of such a large number of components that their only proper description is in terms of continuous distribution functions of a suitable characteristic variable. A methodology is presented here to describe the oils in terms of a generalized distribution function. The characteristic variable is determined from measurements of the equilibrium ratios of two test oils, at ambient pressure. Application of the proposed methodology to a sequence of operations shows that, unlike the pseudocomponents technique, the level of accuracy can be maintained. 22 refs., 10 figs., 4 tabs.

13065 **(DOE/PC/70006—T7) Enthalpy and phase behavior of coal derived liquid mixtures: Technical progress report for the period October-December 1986.** Yesavage, V.F.; Kidnay, A.J. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 1 Jan 1987. Contract FG22-84PC70006. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004509.

The objectives of this program are to study the enthalpy and phase behavior of a selected ternary model compound system, representative of interactions present in coal derived liquids. Measurements have been made in a Freon 11 reference fluid-boil-off calorimeter, and an equilibrium flash vaporization apparatus. During the tenth quarter, enthalpy measurements for the m-cresol/quinoline/tetralin ternary system have been initiated and are included in Appendix A. Vapor liquid equilibria measurements for the m-cresol/quinoline/tetralin ternary system have been completed for four isotherms: 250, 275, 300, 325°C, at various pressures. These results and a summary of progress to date for the VLE apparatus are in Appendix B. Also, predictions for the ternary system using the binary interaction parameters generated from previously obtained binary data were completed, and these results are also presented in Appendix B.

13066 **(DOE/PC/70799—T7) Identification of nonvolatile coal derived products via chromatography coupled with on-line FTIR [Fourier Transform Infrared Spectrometry] detection: Quarterly progress report for the period March 1, 1986-May 31, 1986.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jan 1987. Contract FG22-84PC70799. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003848.

The analysis of nonvolatile coal-derived liquefaction products for minor and trace components which contain nitrogen, oxygen or sulfur presents unique challenges. Justification for their analysis rests on the premise that heteroatom-containing materials can aid and/or hinder the conversion process. This proposal builds upon our efforts during the initial three year grant period regarding the interfacing of Fourier transform infrared spectrometry with size exclusion and normal phase chromatography for the analysis of coal-derived products. Four objectives are proposed: (1) optimize the HPLC-FTIR interface in terms of detectability, identifiability and chromatography, (2) extend the HPLC-FTIR approach to reversed phase chromatography wherein more efficient separations are possible for heteroatom species, (3) determine the feasibility of interfacing supercritical fluid chromatography with FTIR for the analysis of coal-derived products and (4) employ hyphenated methods to ascertain on a molecular level the changes that occur in a nonvolatile coal derived product when various liquefaction parameters are varied. In this quarterly report, a review of the progress and current status of liquid chromatography-Fourier transform infrared spectrometry is provided. Advantages, disadvantages and limitations of the many LC/FTIR methods are described. 52 refs., 10 figs., 2 tabs.

13067 **(DOE/PC/80503—T5) Transport and relaxation processes in supercritical fluids: Technical progress report for the grant period 9-16-86 to 12-15-86.** Jonas, J. (Illinois Univ., Urbana (USA). Dept. of Chemistry). 1986. Contract FG22-85PC80503. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004233.

Quadrupolar nuclei are frequently difficult to observe by NMR spectroscopy owing to their broad resonances, which result from efficient quadrupolar relaxation. Since the quadrupolar relaxation rate is dependent upon the molecular correlation time, which is, in turn, directly proportional to the solvent viscosity, lowering the solvent viscosity will decrease the linewidth and make the resonance easier to observe. Typically, this might be accomplished by judicious choice of solvent or raising the solution temperature. However, the range of accessible viscosities using common organic solvents below their boiling points is necessarily limited. Much

lower viscosities, and a wider range of viscosities, are available in supercritical fluids by adjusting the temperature and pressure. Thus, the use of supercritical fluid solvents affords a means of narrowing resonances from quadrupolar nuclei. This procedure was first proposed and demonstrated in a recent study by Robert and Evilia, who used neat supercritical fluids or gases dissolved in supercritical solution. Recently in this laboratory we have developed an in situ NMR technique to study solid-supercritical fluid mixtures. As an extension of our technique and the work of Robert and Evilia, in this Note we present the first demonstration of line narrowing for solid and liquid solutes containing quadrupolar nuclei dissolved in supercritical fluid solvents. 5 refs., 1 fig., 1 tab.

13068 **(DOE/PC/80519—5) Diffusion of gases in coals and chars: Technical progress report, quarterly report No. 5, 9/15/86-12/14/86.** Smith, D.M. (New Mexico Univ., Albuquerque (USA). Powders and Granular Materials Lab.). 1986. Contract FG22-85PC80519. 16p. NTIS, PC A02/MF A01. File Number DE87005038.

Work during the past quarter involved: (1) surface area measurement; (2) mercury porosimetry; (3) NMR pore structure analysis; and (4) diffusion measurements. Surface area measurements via both nitrogen and carbon dioxide adsorption were completed for all group A coals. Four particle sizes of three coals were studied with mercury porosimetry. NMR relaxation experiments were used to determine continuous pore size distributions. Activity concerning diffusion measurements has been in the area of improving experimental design for both the pellet string reactor and batch desorption experiments. 1 ref.

13069 **(DOE/PC/90507—T1) Surface properties of coal and their role in coal beneficiation: Technical progress report, 15 September to 14 December 1986.** Fuerstenau, D.W. (California Univ., Berkeley (USA). Coll. of Engineering). Jan 1987. Contract FG22-86PC90507. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004115.

The principal objective of this research work is to identify the properties of coal that determine its wetting characteristics and subsequent behavior in coal cleaning processes. To achieve this aim, a detailed investigation of both the bulk and surface properties of coal is being undertaken. Initial work included continued survey of the literature on coal surface science papers. The main part of the experimental work involved study of the kinetics of coal oxidation, as delineated through the film flotation response of the oxidized coal particles. To assess the kinetics of coal oxidation, 100 x 150 mesh bituminous coal, Cambria No. 78 and Dave Johnston subbituminous coal samples were thermally oxidized at 244°C for 1, 2, 4, 8 and 19 hours. Each oxidized sample was then subjected to film flotation in aqueous methanol solutions. The film flotation partition curves for each of the samples are given in Figures 3 and 4. The mean wetting surface tension increases as the oxidation time increases, similar to the changes observed when the oxidation temperature is increased at constant time. These results indicate that the increase in mean wetting surface tension decreases as the time of oxidation is increased, indicating progressive saturation of the coal surface and attainment of some sort of equilibrium with respect to surface oxidation. The film flotation results will be interpreted in terms of mathematical models of the oxidation of bituminous coals. However, before modeling the kinetic behavior oxidation of these coals will be carried out at lower temperatures. Other representative coals will be included in the experimental part of this program. 4 figs.

13070 **(DOE/PC/90508—T1) Continuous thermodynamics and group contribution methods for coal liquids: Quarterly report, 10/1/86-12/31/86.** Allen, D.T.; Behmanesh, N. (California Univ., Los Angeles (USA). Dept. of Chemical Engineering). 1987. Contract FG22-86PC90508. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003838.

In previous DOE projects, coal liquefaction products from the H-Coal, Wilsonville and SRC-II processes were separated into 28 K narrow-boiling range fractions. Information resulting from elemental analysis, proton nuclear magnetic resonance (^{1}H NMR), low-voltage high-resolution mass spectrometry (LVHRMS), infrared spectroscopy (ir) and open-column preparative liquid chromatography were obtained for each narrow boiling distillate of the H-coal and Wilsonville processes. The data obtained on the SRC-II fractions were elemental analysis, infrared spectroscopy (ir), high-performance liquid chromatography (HPLC) and high-voltage low-resolution mass spectrometry (HVLRMS). This work has focused on using the available analytical data to determine the major functional groups in the distillates and to estimate their concentrations. 23 refs., 1 fig., 11 tabs.

13071 **(DOE/PC/90519—1) Electrochemical characterization and derivatization of coal: Technical progress report covering September 15-December 14, 1986.** Park, S.M. (New Mexico Univ., Albuquerque (USA). Dept. of Chemistry). 1986. Contract FG22-86PC90519. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004210.

Preliminary work has been initiated to study catalytic activities for mediated reduction of coal by anion radicals of several aromatic compounds. At the same time, electrochemical cells have been designed and are currently being made for effects of both temperature and pressure on reaction rates and product distribution for the electrochemical oxidation of coal. The work was divided into two subprojects: electrochemical characterization and derivatization. For the first subproject, we ran a number of transient electrochemical experiments using various organic compounds as candidates for catalysts for electrochemical reduction of coal. Transient electrochemical techniques used include cyclic voltammetry (CV), chronopotentiometry, and chronoamperometry. Experiments were run in acetonitrile as a solvent with 0.10 M tetra-n-butylammonium perchlorate (TBAP) as a supporting electrolyte. A platinum disk electrode was used as a working electrode (area = 0.0196 cm^2) with a platinum wire spiral as a counter electrode and a silver wire as a counter electrode. Acetonitrile was dried by distilling over phosphorus pentoxide (P_2O_5) twice under vacuum. The candidate compound (~ mM quantity) was dissolved in acetonitrile along with the supporting electrolyte and experiments were run first without and then with coal slurry present. Experiments were run in strictly deaerated media either by preparing solutions under vacuum or by bubbling helium through the solution.

13072 **(DOE/PC/90520—T1) Structural environment of metallic constituents in coals: Quarterly report, 09/15/86-12/15/86.** Bauer, S.H. (Cornell Univ., Ithaca, NY (USA). Baker Lab.). 20 Jan 1987. Contract FG22-86PC90520. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004368.

The first group of samples was assembled for examination via EXAFS at CHESS and at SSRL. Nine samples containing titanium (coals, reactor deposits, bottom resids) were obtained and prepared for runs to be made when beam time was allocated to this project. Reference compounds, structures of which are known were also assembled [Ti metal, for precise location of the K-edge position; TiO_2; TiC; $TiO(AcAc)_2$; TiN]. These spectra will facilitate the interpretation of the NEXAFS and EXAFS spectra of the coals.

13073 **(DOE/PC/90534—1) Supercritical fluid chromatography/supersonic jet spectroscopy: Progress report, 9/15/86-12/15/86.** Goates, S.R.; Lee, M.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1986. Contract FG22-86PC90534. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004583.

Supersonic jet (SJ) expansions of gaseous molecules can result in much simplified and highly resolved laser-induced fluorescence spectra, allowing analysis of closely related components in a complex sample. We have previously demonstrated that large polycyclic aromatic hydrocarbon (PAH) molecules of low volatility can also be introduced into the jet by means of supercritical fluid (SF), rather than gaseous, carriers and very good spectral narrowing achieved. Last summer in our first attempts with total fluorescence detection in a coupled capillary SFC/SJ system, selective detection of perylene in an artificial mixture of ten PAH and in the coal tar extract sample was achieved. However, only rather poor chromatographic separation was obtained, due in part to a high linear velocity of the fluid through the chromatographic column with the short capillary nozzle which was employed. The extended pressure gradient with most of the restrictors commonly used with SFC lead to

conditions within the restrictor where aggregation of solute molecules can occur which seriously degrade the spectral resolution. Successful SFC/SJ requires large but abrupt restriction. Since then we have worked on the problem of a nozzle design which provides low dead-volume and high restriction for efficient chromatographic separation without leading to solute clustering. Several nozzle types were investigated including pinhole, tapered tubular, and porous frit. Disappointing results were obtained with all three types. During this last quarter we have built a light-scattering apparatus and vacuum chamber which can be devoted to testing new nozzles while pursuing spectroscopic studies in our primary chamber. 8 refs., 3 figs.

13074 (EUR—10588-DE-EN-FR, pp 25-41) **Comparative study of the fluorescence characteristics of coal vitrinite using various seam samples.** Wolff-Fischer, E. (Bergbau-Forschung GmbH (Germany, F.R.)). 1986. (In German). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

Comparative investigations of vitrinite fluorescence were undertaken on the basis of 37 coal samples from the Ruhr/Saar deposits and from the Sidney-Bowen coalfield in New South Wales (Australia). By using the fluorescence values in relation to the vitrinite reflectivity Rr as a criterion for coal rank, it is possible to identify clear differences between the 3 coal groups. While the fluorescence characteristics of the Ruhr coals correlate well with the vitrinite reflectivity, the samples taken from the other two coalfields have their own interrelationship. Further organic geochemical analyses of the Ruhr and Saar coal extracts show that differences in the composition of the rank-related secondary bitumen and in the degree of bituminisation are the cause of the individual aberrations affecting the Saar coal characteristics.

13075 (EUR—10588-DE-EN-FR, pp 43-46) **Investigation of coal and coal products using ^{13}C-CP/MAS-NMR spectroscopy.** Kasueschke, I.; Gerhards, R. (Bergbau-Forschung GmbH, Essen (Germany, F.R.)). 1986. (In German). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

^{13}C NMR spectroscopy is widely used for the definition of fluids and has only recently been employed in connection with solid bodies. Now that it is possible to lay down the absorption parameters which allow a quantitative analysis of ^{13}C solids NMR spectra, this report shows that the signal intensities are not adulterated by using the TOSS pulse sequence to suppress rotational sidebands in the solids spectra. The report also presents an excitation method for solid bodies (DDTOSS) which can separate the signals emitted by non-protonated and methyl-carbon atoms from those of CH and CH_3-C atoms. The differentiation method described is applied to a series of coal types of varying rank. It is possible to identify a correlation between the alterations in the NMR structure parameters, the elementary composition and the petrographic data in respect of the various coal samples used. 5 refs.

13076 (EUR—10588-DE-EN-FR, pp 57-66) **Low-temperature demonstration of the interaction between coal and a carbon binder using a laboratory mixing device.** Cwiklinski, C. (Centre d'Etudes et Recherches de Charbonnages de France, Verneuil-en-Halatte). 1986. (In French). Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

By means of a laboratory mixer it was possible to show, using a selection of appropriate operating conditions, variations in the 'consistency' curves as a function of time for a single type of coal - H.V. bituminous Lorraine coal - in association with several binders: chrysene oil, coal pitch, C fuel oil, residue from steam cracking of naptha or gasol. One important parameter was observed: the temperature of the mixing vat, which has a vital effect on the time needed for the consistency of the mix (measured by torque applied) to reach a set value. Thermogravimetric tests carried out on samples taken either before or after the rise in mixing torque indicated that the weight loss associated with pyrolysis is always less than for separated constituents, and distinctly lower in the second case. In this way it was possible to illustrate the increasing interaction of the components of the mix under the effects of the mixing process, and the equipment used was shown to be an invaluable tool for studying the behaviour of such mixes and the optimum conditions for their preparation. 3 refs.

13077 (EUR—10588-DE-EN-FR, pp 143-166) **Chemical characterisation of coals and coal products: studies of sulphur heterocycles in coal extracts.** Mitchell, C.A.; Burchill, P. (National Coal Board, Cheltenham, (United Kingdom). Coal Research Establishment). 1986. Commission of the European Communities, Brussels, Belgium. (CONF-8512113—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (12 Dec 1985).

A separation scheme has been used to isolate sulphur compounds from a series of coal extracts produced under conditions of varying severity. The sulphur-rich fractions were shown to contain exclusively sulphur compounds, generally typical of those in the original extracts. Thiophenic compounds predominated, and no sulphides or thio ethers were identified. Recoveries of the 3- and 4-ring compounds were good, but recovery of the 2-ring sulphur heterocycles was unsatisfactory. Model compound studies have been carried out to establish the fate of the 2-ring heterocycles. 7 refs.

13078 (NERDDP-EG—84-339) **Variations in contents of trace elements in coal from one coal seam.** Swaine, D.J.; Godbeer, W.C.; Morgan, N.C. (Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Div. of Fossil Fuels). 1984. vp. Department of Resources and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

Up to 50 elements were determined in 133 samples of coal from 9 locations in the Lithgow seam, Western Coalfield, New South Wales by optical emission spectrography, atomic absorption spectrometry, neutron activation analysis and chemical methods. Details are given of the analytical methods. The results were compared with those for other Australian coals and with those for some overseas coals. Environmental aspects of the Lithgow coals for combustion are discussed. It is concluded that no untoward effects are likely to occur where there are proper means of particle attenuation.

13079 (NERDDP-EG—84-366) **Products of brown coal conversion: a study using carbon monoxide, synthesis gas and other reductants.** Strachan, M.G.; Pandolfo, A.G.; Johns, R.B. (Melbourne Univ., Parkville (Australia). Dept. of Organic Chemistry). 1984. vp. Department of Resources and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

The report describes the research on brown coal conversion studies performed by the authors between July 1983 - December 1983. The report is primarily concerned with an analytical investigation of the Coal Derived Liquids (CDL) and their fractions produced during an earlier phase of the project. The work discussed encompasses both the development and application of analytical techniques in order to yield both gross structural and molecular level data on the samples.

13080 (NP—7900480) **1985/1986 SOMED [School of Mines and Energy Development] project: A study of catalytic diffusion in coal: Final report.** Kispert, L.D. (Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1986. 30p. SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486 . File Number TI87900480.

A procedure involving nitroxide spin probes of different size has been developed to determine catalyst accessibility and the possible formation of hydrogen bonds in swellable pores of coal after the coal has been subjected to swelling, temperature variation and extraction with acids or bases. Studies have shown that: (1) spin probes can be diffused into untreated high volatile bituminous (HVB) Mary Lee, Black Creek and Illinois No. 5 Coal, but not lignite and medium volatile bituminous Pratt coal unless first extracted with acetic acid or quinoline; (2) small spherical spin probes are

well ordered in 5 A diameter pores while; (3) long chain or bulky spin probes undergo librational motion and are hydrogen bonded in larger cavities; (4) it is possible to examine hydrogen-bonding in swellable pores up to 60 A in diameter by use of specially prepared nitroxide spin probes attached to polymers, however it is not possible to study larger size pores as large spin labels are either insoluble in the swelling solvent or pores with diameters of 60 A do not follow a convenient swelling pattern; (5) ENDOR spectra can be observed from spin probes located in HVB coal making it possible to estimate the type of hydrogen bonding in the pores; (6) the pore size and number distribution has been determined for HVB coals as a function of swelling solvent and temperature profile; (7) the trapped spin probes enable an estimate to be made of the presence of hydrogen-bonding in the pores as a function of swelling solvent, acid or base treatment and size of the pore; and (8) the number of hydrogen bonded sites in the swellable pores is usually only 5 to 20% of those found on the surface of the coal. We have determined a number of structural differences between various bituminous coals upon swelling and acid or base treatments which can be used to suggest different optimized catalysts in the hydrogenation of HVB coal.

13081 **(NZERDC-P—101) Lignite processing, handling and transportation.** (KRTA Ltd., Auckland (New Zealand)). Aug 1986. 58p. KRTA Ltd., Auckland, New Zealand.

The characteristics of lignite as a fuel with special reference to the properties and composition of the South Island, NZ lignite deposits are discussed. Three coals - Hawkdun, Ashers-Waituna and Kaitangata - were evaluated as power plant fuel. Beneficiation processes are reviewed and procedures for handling and storing low rank, high moisture coals in order to prevent deterioration and spontaneous combustion are outlined. Drying and milling operations of lignite by convective evaporation, with direct and indirect heating, and non-evaporative processes at high temperature and pressure are reviewed. Reference is made to a number of promising new technologies. The production of low moisture, lignite-based fuels and the relevant technology and costs are examined with particular reference to bulk transportation of dry pulverized lignite, production of lump fuel and briquettes and suspensions of finely pulverized lignite in oil or water.

13082 **New chemical structural features of coal: the structure of coal products.** Benjamin, B.M.; Douglas, E.C. (Oak Ridge National Lab., TN). *Fuel;* **65**: No. 12, 1735-1739(Dec 1986).

The object of this paper is to demonstrate the usefulness of the transalkylation reaction for determining chemical structural features of products derived from coal. For example, the method is applied to derivatized coals, coals modified by thermolysis, and materials physically or chemically separated from coals. Data are presented for the pyridine soluble and insoluble parts of two coals, an O-methylated coal, a Birch reduced coal, a solvent refined coal, and a coke. Similarities and differences in chemical make-up of these materials are discussed. 15 references, 4 tables.

13083 **Association of major, minor and trace inorganic elements with lignites. I. Experimental approach and study of a North Dakota lignite.** Miller, R.N.; Given, P.H. (Pennsylvania State Univ., University Park). *Geochimica et Cosmochimica Acta;* **50**: No. 9, 2033-2043(Sep 1986).

Lignites resemble peats, the precursors of coals, in containing many carboxylic acid and other functional groups. Consequently much of the relatively small amount of inorganic matter in lignites is present as cations in carboxylates and in chelated coordination complexes, and not only as distinct mineral phases. Consequently the distribution of inorganic matter in lignites will be influenced by the structure of the organic matter, as well as by microbial processes in peats and the geochemical processes involving erosion of rocks and transport of mineral grains and cations in solution. The objective of this study was to seek information on the distribution of major, minor and trace elements in different forms of combination, and in particular to document organic/inorganic interactions in coal formation. Study of the first of five lignites is reported here.

13084 **Structure analysis of coals by resolution enhanced C 13 NMR spectroscopy.** Hagamann, E.W.; Woody, M.C. (Oak Ridge National Lab., Oak Ridge, TN). pp 337-348 of Atomic and nuclear methods in Fossil energy research. Filby, R.H.; Carpenter, B.S.; Ragaini, R.C. New York, NY; Plenum Press (1982).

Solid state C 13 NMR spectroscopy employing the experimental techniques of dipolar decoupling, magic angle spinning, and H 1 - C 13 cross polarization (CP/MAS-C 13 NMR spectroscopy) yields spectra which approach solution C 13-FT-NMR spectra in resolution and sensitivity. The techniques which prove of value in the spectral composition, i.e., convolution difference methods, partial polarization spectroscopy, spectral subtraction and C 13-chemical enrichment, are discussed and employed in the analysis of the products from a reductive alkylation of a typical bituminous coal.

0108 Waste Management

REFER ALSO TO CITATION(S) 13017, 13044, 13130, 13447, 13448, 13449, 13450, 14231, 14232

13085 (CONF-8511246—, pp 126-131) **Dry desulfurization process for exhaust gas desulfurization in grate furnaces of small and medium output.** Hoessle, H.; Michel, B.; Roller, W. (Energieversorgung Oberhausen A.G., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The dry desulfurisation process has been studied for the desulfurisation of exhaust gases by blowing in CaCo/sub 3/ and Ca(OH)/sub 2/ at a power plant travelling stoker. The reduction of the SO/sub 2/ emission has been investigated depending on the stoichiometric Ca/S-ratio. The process has been also studied with respect to the effects concerning the contamination of the heating surfaces, the precipitation efficiency of the electrofilters and the utilisation possibilities and storage stability of the residues. (HGOE).

13086 **(CONF-8602100—Pt.1) Flue-gas cleaning: Processes, plants, measurement techniques, operational experiences. Proceedings.** (Verein Deutscher Ingenieure (VDI) - Gesellschaft Energietechnik, Duesseldorf (Germany, F.R.)). 1986. 244p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

This meeting reports on the latest operational experience with flue-gas cleaning plants. The processes for desulfurization and nitrogen oxide reduction are described and exemplified in the beginning, as not every participant of the meeting can be expected to be sufficiently informed on the state of the development to be able to make a correct assessment of operational experience. Since operational experience is largely based on measurements, and measuring techniques to monitor emissions must satisfy many novel demands, measuring techniques also form an object of this meeting. 19 out of 23 lectures delivered were recorded separately.

13087 (CONF-8602100—Pt.1, pp 6, Paper 1.1) **Desulfurization - an overview of desulfurization processes.** Baumueller, F. (Grosskraftwerk Mannheim A.G., Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

The report provides an overview of flue gas desulfurization plants ordered in the Federal Republic of Germany up to the beginning of 1985 grouped according to end products. To the total capacity for desulfurization at that time of over 30,000 MW/sub el/, some further plants were added in 1985. More than 90% of these

processes have gypsum as an end product, the remaining ones split up into processes having the end product ammonium sulfate as well as elementary sulfur, or sulfuric acid.

13088 (CONF-8602100—Pt.1, pp 9, Paper 1.2) **Explanation of the desulfurization processes at selected plants.** Schoenbucher, B. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

As processes for the desulfurization of flue gases from coal-fired power plant units, the ones based on lime-limestone wet scrubbing now have a share in the market of around 90%. All these processes are based on the same principle. However, they differ with regard to the techniques used for the individual process steps. The different techniques for the process steps: pretreatment of operating materials, absorption, processing of gypsum suspension and flue-gas reheating are presented and discussed.

13089 (CONF-8602100—Pt.1, pp 18, Paper 1.3) **Overview of the processes for nitrogen oxide reduction.** Weber, E.; Huebner, K. (Essen Univ., Gesamthochschule, Germany, F.R.). 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

Besides the catalytic processes used in Japan, a number of other processes for nitrogen oxide reduction in flue gas are currently being investigated in the Federal Republic of Germany and also in the USA at the laboratory and pilot scale. These include non-catalytic dry and wet processes, electron beam process, and the use of catalytic processes in other places of the flue gas path. As conditions are different in comparison with Japan, some of the process alternatives tested in the Federal Republic of Germany at any rate seem interesting enough so that demonstration plants are either envisaged or have already started operation.

13090 (CONF-8602100—Pt.1, pp 9, Paper 1.5) **Processes and plants for combined SO/sub 2//NO/sub x/ reduction.** Haessler, G.; Fuchs, P. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

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The pilot plants for SO/sub 2//NO/sub 2/ reduction that are currently being developed in the Federal Republic of Germany have, without exception, not yet been tested on an industrial scale. They can be roughly divided according to wet and dry scrubbing processes. Six representative processes are compared as to process design and investment expenditure. Any data provided in the lecture are based on information by the manufacturers, results from pilot plants are taken into account. As the processes are still at a certain stage of development, no definitive statements can as yet be made as to the cost involved, certainly not the operational cost.

13091 (CONF-8602100—Pt.1, pp 6, Paper 2.2) **Measuring techniques to monitor the operational behaviour of flue gas cleaning plants.** Natusch, K.; Ratajczak, W. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

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Measuring techniques have the following tasks: Establishment, evaluation and recording of measuring values: according to the Ordinance on Large-sized Surfaces, within the process of flue gas desulfurization as a means of process control and monitoring, for control and acceptance tests. The following conditions apply to the selection of measuring devices: for continuous emission monitoring only type-tested measuring devices may be used, measurement techniques must be in accordance with "VDI" guidelines and measuring data are to be put on record, evaluated and stored by type-tested process computation systems.

13092 (CONF-8602100—Pt.1, pp 6, Paper 2.3) **Demands on measurement techniques to analyse flue gas from the legal viewpoint.** Leidinger, B. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

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By laying down limiting values for emissions, which differ for new respectively older plants according to fuel type and combustion technique, the Federal German Government has restricted the permissible concentration of emissions from furnaces having a capacity of 50 megawatts and above. This restriction became effective as of July 1, 1983. Under the Federal German Law on Immissions, operators are required to additionally present to the surveillance authority a statement each year on the air pollution caused by the plant. Measurements may be carried out by the authorities entirely at their discretion.

13093 (CONF-8602100—Pt.1, pp 12, Paper 2.4) **Current monitoring of emissions according to the Clean Air Act and the Ordinance on Large-Sized Furnaces.** Guedelhoefer, P. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

The demands of the 1974 Clean Air Act on continuous emission monitoring were extended and concretized. This was brought about not least because manufacturers developed new measuring devices or developed old ones further. Since July 1983 the Ordinance on Large-Sized Furnaces has been in force, demanding from July 1985 for large-sized furnaces, not only current registration of emissions, but also statistical evaluation of measuring results. To date the termination of a further amendment to the Clean Air Act is imminent. The cabinet of ministers have decided to intensify current monitoring of emissions.

13094 (CONF-8602100—Pt.1, pp 14, Paper 3.1) **Operational experience of STEAG AG with flue gas desulfurization plants downstream of 700-megawatt, black-coal-fired power plant units.** Breidenbach, H.; Hoehmann, P. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

After a total operation time of some 65,000 hours, the flue gas desulfurization plants at the Bergkamen and Voerde power plants have confirmed the appropriateness of the concept of flue gas cleaning on the basis of lime. Improvements in materials and constructions were necessary especially in the sectors pipes, fixtures, and compensators. In executing the second extension stage, further technical developments made meanwhile were fully considered.

13095 (CONF-8602100—Pt.1, pp 5, Paper 3.2) **Operational experience with flue gas desulfurization plants of VKR AG.** Gutberlet, H.; Kuebler, D. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

In 1984 the plant shifted to the use of limestone powder instead of lime hydrate; the subsequent experience with the new agent is reported in the paper. Essential components of the process are: a pre-washer respectively cooler for preliminary separation of hydrogen chloride, hydrogen fluoride, and dust as well as an absorber with dripping elements from plastic material to improve ma-

terial transition. To each washer belongs an oxidation container for oxidation of calcium sulfite into calcium sulfate. One of the first things noted by the operators was the fact that such an oxidation container can be dispensed with as long as a low pH value is maintained in the absorber cycle. The pH value of the absorber cycle had to be abated from 5.4 to 5.0. Under these conditions, and at SO/sub 2/ concentrations of up to 2000 mg/m/sup 3/, the maximum degree of desulfurization achieved was 95% when the plant was being operated to capacity. By contrast, at higher concentrations of SO/sub 2/ the degree of desulfurization achieved decreased substantially during operation to capacity.

13096 (CONF-8602100—Pt.1, pp 17, Paper 3.3) **Operational experience with flue gas desulfurization plants at the power plants Bexbach and Weier and the model-type power plant at Voelklingen.** Schuetz, M. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

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Two different processes are used at "Saarberg" power plants to desulfurize flue gases. The first two plants, Weiher III,1 and the model-type plant, use white fine lime as an agent, while the newer ones like Weiher III,2 and the Bexbach power plant employ limestone. Today the reagents and mode of operation of the carbonate plants are chosen so as to assure that, while 90% and more desulfurization is attained, marketable gypsum is produced simultaneously to the absorption of SO/sub 2/ in the scrubbing line. To dehydrate gypsum, centrifuges have proved a suitable device.

13097 (CONF-8602100—Pt.1, pp 7, Paper 3.4) **Operational experience with flue gas desulfurization equipment at the Karlsruhe steam power plant (Rheinhafen) and the Mannheim large-sized power plant.** Strasser, P.; Fuetterer, V. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

In the case of the large-scale power plant at Mannheim, existing problems in carrying out ammonium sulfate, a product in powder form, can be brought under control by further otpimization. No difficulty is encountered in the sale of the fertilizer produced. Retention of aerosols by a new, 4-stage separation system is yet being tested; a final judgement can be given not before the end of the winter traveling season 1985/86. As yet, no restrictions to the availability of the flue gas desulfurization plant at the Mannheim plant have been experienced. The degree of desulfurization and chloride separation are above the guaranteed levels. Incrustations at components have not so far occurred to any large extent. Drying and briquetting of the gypsum produced by flue gas desulfurization must be further optimized. Problems like foam formation and chloride being carried out could be or will soon be solved.

13098 (CONF-8602100—Pt.1, pp 10, Paper 3.5) **Operational experience with flue gas desulfurization systems at VEW AG.** Karger, R. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

The paper deals with the flue gas desulfurization system installed at a plant of Vereinigte Elektrizitaetswerke Westfalen (VEW) AG. Contrary to all other flue gas desulfurization systems in operation by VEW, certain influences on the process conditions resulted for this system from the combined-cycle operation of the power generation unit, entailing changes in the process design. Furthermore the results of operation with different lime qualities are compared.

13099 (CONF-8602100—Pt.1, pp 6, Paper 3.6) **Operational experience with flue gas desulfurization systems at the Wilhelmshaven power plant.** Stellbrink, B. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

On the basis of experience gathered, the operators were induced to erect simple, large plants of safe operation and high efficiency pertaining to separate power generation units each and built in compact form. Owing to the use of a regenerative heat exchanger (system GAVO), no additional energy is required to reheat the flue gases after desulfurization. The booster blower integrated in the clean gas flue which is situated immediately above the GAVO maintains the high degree of desulfurization of the gas after wet scrubbing, reduces driving energy required for the blower and saves investment cost. Gypsum suited to be used in the construction industry is obtained during the flue gas desulfurization process as a residue.

13100 (CONF-8602100—Pt.1, pp 18, Paper 3.7) **Operational experience with a dry/semi-dry flue-gas desulfurization method according to the Lurgi fluidized-bed absorption process at the Schwandorf power plant of Bayernwerk AG.** Schmole, C.; Dietl, R. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01 . File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

The paper describes the bases of dry flue gas desulfurization in a circulating fluidized bed and outlines the process. Furthermore the design output data and automatic control system are described. Further topics are the start of operation, acceptance measurements, test operation and operational experience. Now that experience has been gathered it can be said that this fluidized-bed absorption system constitutes a flue-gas desulfurization process permitting to abide by the limiting values laid down in the Ordinance on Large-Sized Furnaces.

13101 (CONF-8602100—Pt.1, pp 7, Paper 4.1) **Operational experience to date with plants for nitrogen oxide reduction: Problems solved and unsolved.** Wittig, S. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

According to the current state of technology it is not possible to observe the limiting values for NO/sub x/ emission solely by adequate combustion technique. Also any large-sized furnace will probably have to be equipped in future with a system for denitrification of flue gases. The paper surveys the processes currently available for secondary NO/sub x/ reduction and their mechanisms of action.

13102 (CONF-8602100—Pt.1, pp 28, Paper 4.2) **Experience gathered by STEAG AG with pilot plants for nitrogen oxide reduction.** Hannes, K.; Eichholtz, A. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

Operation of a melting-chamber combustion system in the medium-load range caused all test catalysts used to sustain great losses of activity already after a relatively short time. SCR catalysts which have been tested since February 1985 downstream of a flue gas desulfurization unit did not hitherto show any such loss of activity. The regenerative gas preheater used to heat the flue gas also functions smoothly so far.

13103 (CONF-8602100—Pt.1, pp 7, Paper 4.4) **Operational experience with the nitrogen oxide reduction system at the Altbach-Deizisau power plant.** Necker, P. 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

In December 1985 the first technical-scale plant for nitrogen oxide reduction on the basis of the SCR process was put into operation. The plant, whose design is for NH/sub 3/ injection, will have had some 750 hours of operation by mid-February. First start-of-operation measurements have shown the necessity for adjusting the quantities of NH/sub 3/ to be injected which were calculated before hand by pilot experiments. During start-up and shut-down and when load changes, the temperature limits currently to be observed for catalyst operation still entail restrictions on boiler operation. The report deals with those first experiences.

13104 **(PB—87-133096/XAB) Pilot-scale evaluation of top-inlet and advanced electrostatic filtration. Final report, February-September 1985.** Viner, A.S.; Greiner, G.P.; Furlong, D.F.; Hurst, R.G. (Research Triangle Inst., Durham, NC (USA)). Nov 1986. 68p. (RTI—47U-2519-7). NTIS, PC A04/MF A01.

The report gives results of an evaluation of Advanced Electrostatic Augmentation of Fabric Filtration (ESFF) on a slipstream from a stoker-fired boiler. Advanced ESFF, with its characteristic high-voltage center-wire electrode, was compared with conventional filter bags in the same baghouse using calibrated flow orifices. The advantage of advanced ESFF was demonstrated by consistently higher gas flow rates in the bags with the corona-producing electrodes. Analysis of the data showed that the specific resistance of an electrostatically enhanced filter was 70% less than that of a conventional bag. An economic analysis showed a capital cost savings of 26% with advanced ESFF based on doubling the air/cloth ratio for advanced ESFF. In a second test, the feasibility of using top-inlet filtration on stoker fly ash was established. No definitive comparison with conventional bottom-inlet filtration could be made in the allotted test period.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 13429, 13430, 14465

13105 **(CRIEPI—285029) Evaluation of environmental impacts of coal ash and dust - characteristic of airborne particulates.** Nakayama, T. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.). 1986. vp. (In Japanese). Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan Energy and Environment Lab.

This paper describes the result of field tests on chemical components in atmospheric suspended particulates and soil. The field tests were done at Western Nagasaki Prefecture in 1983 and Lake Saroma (East Coast of Hokkaido Island) in 1984. Thirty-four heavy metals and BaP concentrations were measured in the partiiculates and the soil. Those trace elements are supposed to be involved in air pollutants from coal thermal power plants. Each trace element concentration in the suspended particulates at Lake Saroma was approximately the same or less than the one at Western Nagasaki. All the trace element concentrations in the suspended particulates at both areas were less than those of published data from Environmental Agency of Japan. This paper concludes that major sources of trace elements in the suspended particulates are soil and ocean. This paper also expects other possible emission sources than coal power plants for those trace elements such as S, V, Zn, As, Pb and Cd.

13106 **(CRIEPI—285049) Adsorption characteristics of arsenic and boron by soil.** Sakata, M. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.). 1986. vp. (In Japanese). Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.

In order to obtain baseline data concerning the surface and ground water pollution caused by coal ash disposal, adsorption characteristics of arsenic (III) and boron by soil have been studied through laboratory experiments. The main results are as follows: (1) Arsenic (III) and boron adsorption on soil was strongly dependent on pH with adsorption maxima at pH 8 and 8-9, respectively. (2) Arsenic (III) and boron adsorption on soil over the entire concentration ranges investigated could be described by the Langmuir adsorption isotherm and the Freundlich adsorption isotherm, respectively. The Henry adsorption isotherm was also applicable over the lower concentration ranges of arsenic (III) and boron (As (III): < 0.1 δg/ml; B: < 5δg/ml.) (3) Arsenic (III) and boron adsorption on soil is controlled mainly by the contents of extractable Fe oxide and hydroxide for arsenic (III) and by the contents of extractable Al hydroxide and allophane (amorphous aluminium silicates) for boron. (4) Adsorption and movement of arsenic (III) and boron during the infiltration of coal ash leachate in soil layer were investigated by means of the unsteady-state, one-dimensional convective-diffusive mass transport model. This model is very useful for evaluation and prediction of the contamination of ground water by trace elements such as arsenic (III) and boron leached at coal ash disposal site.

13107 **(CRIEPI—481017) Effects of trace elements from coal-fired power station on vegetation: a review.** Kohno, Y.; Takanashi, S.; Fujiwara, T. (Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Bio-Environment Lab.). Mar 1982. 80p. (In Japanese). Central Research Inst. of Electric Power Industry, Abiko, Chiba, Japan. Bio-Environment Lab.

Increasing coal power generation resulting from a shift to coal as an energy source, will result in environmental problems. This report summarizes the effects of trace element emissions from the stack on soil and vegetation around power stations, and about trace element uptake and accumulation by plants associated with agricultural utilization and disposal of large amounts of fly ash. Trace element concentrations of fly ash are dependent on many factors such as geological origins of coal, combustion conditions and particle size of the fly ash. There are reports that concentrations of some elements in soil and or/vegetation rapidly fall with distance from the power station and tend to be at background levels at distances beyond several kilometers. However it appears that atmospheric releases of trace elements are not likely to have significant and hazardous effects on soil and vegetation near the station. Fly ash application to soils can be an effective amendment in neutralizing soil acidity. In contrast uptake and accumulation of trace elements by plants grown on fly ash-amended soils appear to be the most serious problem associated with increasing land application of large amounts of fly ash to soil. 103 refs.

13108 **(ECN—85-42) Analytical chemical research on air pollution from flue gas.** Slanina, J. (Netherlands Energy Research Foundation, Petten). Nov 1985. 140p. (In Dutch and English). ECN, P.O. Box 1, 1755 ZG Petten, The Netherlands.

This project was carried out within the framework of the National Coal Research Programme which is financed by the Ministry of Economic Affairs. The aim of the project was to develop or optimize a number of analytical procedures for the measurement of trace compounds in precipitation and in air. These included: introduction-coupled plasma emission spectrometry; flow injection analysis differential pulse anodic stripping voltametry; hydride generation atomic absorption spectrometry. The import and export of air pollution in the Netherlands have been calculated by means of a model based on air mass trajectories. Results are presented. 20 refs.

13109 **(NATO—150) Final report of the air pollution pilot study control strategies and impact modelling.** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). Nov 1984. 51p. NATO, Committee on the Challenges of Modern Society.

This final report has been prepared by the Pilot Study WEorking Group for submission to the CCMS. The conclusions reported are relevant to the overall framework and objectives for the pilot study approved by CCMS, that: air pollutants have adverse

effects on human health and the environment; suitable measures to assess the level of air pollution and to serve as a basis for the development of control strategies are available; emissions can be reduced significantly by means of technically feasible control measures, continuous emission monitoring techniques are in an advanced stage of development; air pollutants often are transported across national boundaries; considerable progress has been achieved in developing models for calculating transport and diffusion of air pollutants in the atmosphere. These factors allow the development of an effective air quality management system.

13110 **(PB—87-117123/XAB) Reclaiming prime farmlands and other high-quality croplands after surface coal mining. Staff memo.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Dec 1985. 145p. NTIS, PC A07/MF A01.

The Staff memorandum was prepared in support of the Office of Technology Assessment entitled Western Surface Mine Permitting and Reclamation. These provisions were intended to end the historical inadequacy of reclamation practices to return mined prime farmland to a condition capable of supporting its original, intensive agricultural use. The summary presents the results of OTA's analysis of technical concerns and some of the more readily evaluated institutional concerns associated with Surface Mining Control and Reclamation Act's provisions for prime farmlands and other high-quality croplands.

13111 **(VROM—84728/11-84) Indicative multi-year programme to control air pollution 1985-1989.** (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands)). Oct 1984. 18p. Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague, Netherlands.

Central government policy to control air pollution in 1985-1989 is described.

13112 **(VROM—8462319-84) Air Pollution Act.** (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague (Netherlands)). Dec 1983. 28p. Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, The Hague, Netherlands.

The Air Pollution Act for the Netherlands is presented.

13113 **Sulfate and carbonaceous aerosols in Beijing, China.** Dod, R.L.; Gianque, R.D.; Novakov, T.; Su Weihan; Zhang Quipeng; Song Wenzhi. (Univ. of California, Berkeley). *Atmospheric Environment;* 20: No. 11, 2271-2275(1986).

Results of our aerosol study, performed during 1983-1984 in Beijing, demonstrate that ambient carbonaceous aerosols are derived principally from coal combustion. Different SO_2 oxidation processes have been observed in summer and winter. The winter sulfate appears to be produced locally and associated with products of incomplete combustion. 11 references.

0110 Reserves And Exploration

13114 **(SECV-SO—85-93) The cyclic occurrence of brown coal lithotypes.** Mackay, G.H.; Attwood, D.H.; Gaulton, R.J.; George, A.M. (State Electricity Commission of Victoria, Melborune (Australia). Brown Coal Research Div.). 1985. 23p. State Electricity Commission of Victoria, Melborune, Australia. Brown Coal Research Div.

Sequences of lithotypes in the Morwell seam of the Latrobe Valley brown coals have been examined. It has been found that: (I) the lithotypes are cyclic on a coarse scale and exhibit oscillation on a fine scale; (II) lithotype cycles lighten upwards; (III) the coal seam overall lightens and becomes more distinctly banded towards the top of the seam. On the basis of the study reported a model of lithotype formation which differs from that of previous studies of Latrobe Valley brown coals, is presented. 39 refs.

0120 Mining

13115 **(BHRA-RR—1914) Test results of NCB solenoid stop valves.** Smithson, J.H. (British Hydromechanics Research Association, Cranfield). Oct 1982. 44p. British Hydromechanics Research Association, Cranfield.

This report contains the results of and comments on tests carried out on two solenoid control valves. The tests were carried out in accordance with the National Coal Board (NCB)/BHRA agreed test programme. During the programme some modifications to the test procedure and additional performance checks were agreed between BHRA and NCB and added to the programme. Some development work was needed on the valves, resulting in a number of internal modifications being made. Due to this, the results of tests carried out prior to the various modifications might not be accurate for the current build standard of the valve. Details of valve modifications are documented in this report. Neither of the valves submitted for test completed the test programme satisfactorily. One valve would not operate satisfactorily in the specified contaminated environment, even after modifications.

13116 **(CSIRO-DG-GCM—61) Data acquisition system for longwall support monitoring at Ellalong Colliery.** Dean, A.; Bride, J. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics). 1986. 18p. Commonwealth Scientific and Industrial Research Organization, Mount Waverley, Australia. Div. of Geomechanics.

An intrinsically safe data acquisition system, developed at the Division of Geomechanics, was used to sample the levels of hydraulic pressure in powered longwall supports at Ellalong Colliery in the Hunter Valley region of New South Wales. This report summarises the basic features of the system and its components and describes the logistical requirements for installation and operation.

13117 **(CSIRO-DG-GCM—62) Aspects of support and strata performance on Longwall No. 1 at Ellalong Colliery.** Wold, M.B.; Pala, J. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Geomechanics). 1986. 30p. Commonwealth Scientific and Industrial Researach Organization, Mount Waverley, Australia. Div. of Geomechanics.

Hydraulic leg pressures in selected powered supports were measured during mining Longwall No. 1 at the Ellalong Colliery, using a specially designed, intrinsically safe automatic monitoring system. In conjunction with measurements of support closures, and observations of strata behaviour, the pressure records provided a basis for interpreting the behaviour of the Greta Seam roof under initial longwalling conditions. The analysis suggests that 'first weight' and subsequent periodic 'weighting' of the supports may be related to the structural performance of a competent sandstone bed 10-20 m above the Greta Seam.

13118 **(PB—87-103164/XAB) Dust control on longwall shearers using water-jet-assisted cutting. Information Circular.** Taylor, C.D.; Kovscek, P.D.; Thimons, E.D. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1986. 17p. (BM-IC—9077). NTIS, PC A02/MF A01.

The Bureau of Mines equipped a longwall shearer with a water-jet-assisted cutting system and measured dust levels during the cutting of a simulated coal block. The block was cut dry, at a conventional water-spray pressure of 190 psi, and with water-jet-assisted cutting pressures ranging from 1000 to 6000 psi. At water pressures of 3000 psi and higher, dust concentrations were reduced by as much as 85% via water-jet-assisted cutting in comparison with conventional water sprays.

13119 **(PB—87-113932/XAB) Shield mechanics and resultant load-vector studies. Report of Investigations/1986.** Barczak, T.M.; Garson, R.C. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1986. 51p. (BM-RI—9027). NTIS, PC A04/MF A01.

Library of Congress catalog card no. 85-600351.

The term resultant load vector is defined as the representation of the forces applied to a longwall roof-support element by

strata activity through a single, quantifiable measure of support resistance. The relatively complex kinematics of the shield structure prohibit determination of support resistance simply from the summation of leg forces. In the research reported in the Bureau of Mines study, the mechanics of the shield structure were evaluated and a technique was developed whereby the resultant shield loading could be determined by instrumenting supports with pressure transducers and strain gages to measure leg, canopy capsule, and lemniscate link forces. The technique was laboratory tested in the Bureau's Mine Roof Simulator. Functional relationships among variables were assessed, and confidence intervals were established for prediction of the resultant load-vector parameters. Resultant load measurements were taken on five instrumented shields on an active longwall face in Colorado. Results were analyzed and found to be consistent with shield mechanics and anticipated roof behavior. Benefits to be derived from the research, future efforts, and long-range goals are discussed.

13120 **(PB—87-116976/XAB) Cutter roof failure: an overview of the causes and methods for control. Information Circular/1986.** Hill, J.L. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1986. 34p. (BM-IC—9094). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 86-600247.

The Bureau of Mines is conducting research on the causes and methods for control of cutter roof failure in underground coal mines. The hazardous ground-control problem exposes miners to the danger of falling roof rock and frequently results in massive roof failure. The report outlines the probable causes of cutter roof failure, which are based on field investigations, numerical model analysis, and in-mine observations. Traditional methods of control are presented, as well as innovative methods based on mining concepts developed during earlier years of coal-mining history. The report can be useful to a mine operator for assessing the causes of cutter roof failure on a site-by-site basis and for predicting the probability of its occurrence. A process is presented for selecting an optimum control method that includes both traditional and innovative control techniques for each of the various causes of cutter roof failure.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 13081, 13979

13121 **(DOE/PC/70805—8) Fundamental studies of bulk flow of fine coal: Quarterly report for the period April 1, 1986-June 30, 1986.** Hogg, R.; Luckie, P.T. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). Jan 1987. Contract FG22-84PC70805. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004384.

The primary aims of this research project are to investigate the procedures used for evaluating the flow behavior of fine coal and to conduct systematic studies of the relationship between flowability and the fundamental characteristics of the coal particles, with a view to the development of predictive models. An ancillary goal is to investigate the role of bulk flow in the performance of gas cyclones for coal dust collection. This quarterly report presents a standardized procedure for the analysis of shear cell test data. An interactive computer program is described which can be used for statistical analysis of partially replicated test results and yields estimates of the characteristic flow parameters and their associated confidence limits. An example of the application of the program to a set of typical test data is included. 5 refs.

13122 **(NZERDC—127) Transportation of lignite to the North Island.** (KRTA Ltd., Auckland (New Zealand)). Aug 1986. 37p. KRTA Ltd., Auckland, New Zealand.

This report gives a summary of the findings of a study into the technical and economic aspects of transporting lignites from the South Island deposits to points of use in the north of the North Island. Three of the South Island deposits Hawkdun, Kaitangata and Ashers-Waituna are identified as the best source for lignite, whilst Marsden Point is confirmed as the only practical option for a major usage in the north. The actual transport of lignite over long distances is deemed to be impractical at the moment, because of the problems of lignite instability leading to spontaneous combustion and severe size degradation, unless the lignite is processed to a stable lumpy form. The only such process developed to a level whence cost estimates can be provided is briquetting, but some other processes merit further attention. Economic analysis of transport options based on a 1250 MWe demand show that significant improvement in drying/processing techniques would be required before such an option could be favoured. However, if transport of raw lignite were practical, then the higher grades of deposit could be more attractive to transport in the raw state. The costs are presented as a transport cost per tonne and as a delivered fuel cost in terms of costs per kilowatt-hour. A comparison of lignite options, including a lignite-water slurry fuel, is made against black coal imports, indigenous supplies of black coal and generation of power from lignites in the South Island. The generation of electricity in the South Island appears to be the most economical lignite option, whilst the relative costs of mining (or purchase price) black coal against lignites is the major factor in that comparison. It is concluded that transport of lignites to the North Island is highly unlikely to present an attractive means of utilising the South Island deposits.

13123 **(NZERDC-P—102) Slurry transport of South Island lignites.** (KRTA Ltd., Auckland (New Zealand)). Aug 1986. 29p. KRTA Ltd., Auckland, New Zealand.

This report briefly covers the concepts of slurry transport as fine or coarse slurries and reviews the application of slurry techniques to the transport of lignite from the South Island of New Zealand to Marsden Point. Two slurry techniques are identified as having potential, coarse coal loading and a lignite/water slurry fuel produced by a 'hot water drying process'. Order-of-cost estimates for the transport of 6 million t/a of Kaitangata lignite are developed based on loading 110,000 dwt carriers using a single point buoy mooring offshore from the Clutha River mouth. The costs for loading and shipping the fuel to Marsden Point are estimated to be around 15 to 20 NZ dollars per ton (excluding wharfage) when coarse-coal slurry loading is used. The costs for transporting a coal/water slurry fuel from the mine to Marsden Point Power Station are estimated to be around 13 NZ dollars per ton (excluding wharfage), which figure includes unloading and transport to the power station.

13124 **Influence of air on oil agglomeration of carbonaceous solids in aqueous suspension.** Drzymala, J.; Markuszewski, R.; Wheelock, T.D. (Iowa State Univ., Ames, USA). *International Journal of Mineral Processing;* **18**: No. 3-4, 277-286(Nov 1986).

Graphite or coal particles in aqueous suspension were agglomerated with various paraffinic hydrocarbons in a specially developed system which made it possible to exclude air from the system or to conduct agglomeration with controlled amounts of air present. The agglomerates were recovered by screening the suspension. Under certain conditions air was incorporated in the agglomerates which increased the recovery of carbonaceous material with a given amount of liquid hydrocarbon. Incorporation of air occurred when lower molecular weight alkanes (i.e., smaller than octane) were used as the collecting or bridging phase in limited amounts. Air had no effect on the system when higher molecular weight alkanes were employed or when larger amounts of the collecting phase were used. 7 figs., 9 refs.

0140 Combustion

REFER ALSO TO CITATION(S) 13139, 13431, 13432, 13433, 13434, 13437, 13724, 13734

13125 **(CONF-8511246—, pp 55-64) Development of coal dust combustion for small outputs.** Krauss, U.; Becher, U. (Ruhrkohle A.G., Essen, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The coal dust combustion has been tested in an experimental boiler plant for small outputs (<5 MW) for the production of overheated steam. The plant components and some experimental results are given. The plant is characterised by a good burn out and boiler efficiency, less boiler contamination, simple start-up and shut-down and fast controlling ability. (HGOE).

13126 (CONF-8511246—, pp 65-71) **Development and testing of combustion systems - NOVOCAL.** Nickel. (Buderus A.G., Wetzlar, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The combustion systems NOVOCAL (heat output up to 10 MW) were investigated in the pilot plant scale with regard to higher boiler efficiency and the fully automatic operation with different coals and waste fuels. A high pressure water pipe hot boiler with a longitudinally placed drum with three burner chambers is used in this combustion system. (HGOE).

13127 (CONF-8511246—, pp 77-86) **Investigation of coal dust furnaces with multi-step combustion (MSM burner) for reduced NO/sub x/-emission.** Schreier, W. (Steinmueller, L.u.C. G.m.b.H., Gummersbach, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about operational experiences with a 15 MW experimental coal dust firing plant to study the NO/sub X/ reduction by the stepwise addition of the fuel. Excess air coefficients have been defined to characterize the reaction conditions in the individual combustion zones (primary, reducing and burn-out zones). One of the most important parameters concerning the NO/sub X/ emission or the share of non-burned coal is the fuel distribution which is that part of fuel above the primary burner and the stepwise arranged burner nozzles. (HGOE).

13128 (CONF-8511246—, pp 87-92) **Development and demonstration of a reduced NO/sub x/ coal dust firing technology with stepwise air supply to the combustion space using a dry deashed large steam generator.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

For the reduction of the NO/sub X/ emission in coal-fired power plant boilers the combustion air is divided into two streams, the acutal burner being supplied only with a portion of the air and the remaining portion being introduced above the burner planes by separate nozzles. A boiler plant for the 450 MW bituminous coal block of Isar-Amperwerke presently being built is equipped according to this basic concept. (HGOE).

13129 (CONF-8511246—, pp 140-149) **Development of briquets for industrial furnaces.** Lehmann, J. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about briquetting experiments by using different coals, binders and lime additives for preparing briquets for the use in the grate firing. The ignition and burn-out behaviour of the briquets, the desulfurisation effect of the lime additives and the dependence of the desulfurisation on the glow temperature were investigated. (HGOE).

13130 **(CRIEPI—285032) Emission characteristics of NO/sub x/ and unburned carbon in flyash in case of blended pulverised coal combustion.** Sato, M. (Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.). 1986. vp. (In Japanese). Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.

In coal fired utility boilers, some kinds of coals are blended in order to improve the coal's combustibility or to optimize the unburned carbon concentration in fly ash. This study describes the emission characteristics of NO/sub x/ and unburned carbon in fly ash in blended pulverized coal combustion. Main results are as follows: (1) in blended pulverized coal combustion, the relations of fuel bound nitrogen and conversion rate of fuel nitrogen to fuel NO/sub x/ are made clear, so it seems to be able to predict NO/sub x/ emissions; and (2) unburned carbon concentration in fly ash in blended coals combustion can be predicted by the combustion model that unburned carbon mass residual rate in pure coals (not blended) combustion will not be changed in blended coals combustion.

13131 **(DOE/PC/50266—T1) Vaporization and devolatilization of coal water sprays. Final report, August 11, 1982-August 11, 1985.** Meyer, P.L.; Chigier, N. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Mechanical Engineering). 1985. Contract FG22-82PC50266. 193p. NTIS, PC A09/MF A01; GPO Dep. File Number DE86015048.

The atomization performance of a commercially-sized coal-water slurry atomizer has been examined as a function of measurement position, fuel flow rate, air/fuel mass ratio and fuel properties (coal-water slurry or water). Significant differences exist between water and slurry sprays at the same operating conditions. Slurry sprays contain larger drops than water sprays and consequently slurry sprays have a wider spray angle. Both fluids exhibit linear trends in obscuration and mean size as a function of axial position. The profiles of the radial variation of mean size are similar for the two materials. Smaller drops are concentrated near the atomizer center line while larger drops are located near the circumference of the spray. Photographs show that slurries contain "oversized" drops and ligaments beyond the upper size range of the Malvern Particle Sizer with the 300 mm lens. Closeup photographs provide evidence of a few, individual coal particles. The vast majority of images in the photographs are slurry drops, that is water drops containing at least several coal particles. There is no photographic evidence for the complete separation of slurry sprays to form pure water drops and "dry" coal particles. Malvern normalized volume distribution data was transformed to normalized number distributions to determine the relative number of drops in each size band. Over the size range from 5.8 to 564.0μm, the relative number of drops varies by 10^5. At the same operating conditions, water sprays are not an appropriate model for slurry sprays. However, with increasing air/fuel ratio, the weight distribution of slurry sprays in the 5.8 to 564μm range begins to approach the weight distribution of water sprays at lower air/fuel ratios. Much more energy (in the form of atomizing air) is required to achieve slurry sprays with size distributions similar to those of water. 73 refs., 72 figs., 19 tabs.

13132 **(DOE/PC/70770—6) Fundamental studies of the mechanisms of slag deposit formation: Reporting period September 1-November 30, 1986.** Austin, L.G.; Benson, S.A.; Gomez, C.P.; Hurley, J.P.; Schobert, H.H. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). Dec 1986. Contract FG22-84PC70770. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004119.

Good progress was made on the initial stages of assembly of a 7 kg/h down-fired combustor in the Combustion Laboratory. This combustor has several unique features, including a modular design which allows varying the average temperature and particle residence times in the furnace, as well as a large number of gas and temperature sampling parts, which allow determination of temperature and flue gas compositions in the radiant zone, as well as sampling coal particles at various stages of combustion. The furnace base, acceleration section, and four wall modules have been completed. Construction of equipment for cooling the flue gas and of a

high efficiency cyclone for fly ash collection has been started. Work on the development of an automated scanning electron microscopy (SEM) technique for quantitative particle-by-particle analysis of inorganic components of coal was completed. Five computer programs were written to accommodate various aspects of instrument calibration and data collection. Studies of ash formation in a drop tube furnace were also completed. It was found that the strongest ash deposits contain abundant crystalline material, but the weak deposits do not. The key agent in the development of deposit strength was found to be a sodium-containing melt phase, which both dissolves other ash components and causes extensive sintering in the deposit. The primary factors involved in the formation of strong deposits are a source of flux - such as sodium - in the coal and a temperature high enough to allow dissolution of the other ash and to allow sufficient viscous flow of the melt phase for sintering to occur. 3 refs., 3 figs.

13133 **(EPRI-CS—4987) Demonstration of the Combustion Engineering 100-MBtu/h burner for coal-water slurries: Final report.** Rini, M.J.; Marion, J.L.; Lachowicz, Y.V. (Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 120p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920193.

The successful operation of a utility-scale coal-water fuel (CWF) burner was demonstrated at Combustion Engineering over the load range of 20 to 100 million Btu/hr. Two different fuels were tested, one supplied by OXCE Fuel Company and the other by Atlantic Research Corporation. A series of performance targets typical of commercial operational requirements were met during the course of this program. The test furnace was selectively insulated to model the time-temperature history of an oil-fired utility boiler. The two CWFs utilized in this project were atomization tested in CE's Atomizer Test Facility (ATF) using a laser diffraction technique to determine the fuel droplet size distribution and mass median diameter (MMD). The two CWFs were found to atomize equally well in the cold flow spray tests. A total of approximately 70,000 gallons of CWF were fired during the combustion testing. A No. 6 fuel oil baseline test was also conducted to provide comparative data. CWF carbon conversion efficiencies were generally above 98% at the higher loads and normal excess air levels (15% EA). Both steam and compressed air atomization media were successfully employed with essentially equal results, however, NO/sub x/ was somewhat reduced with steam atomization. No operational problems with the burner system on the fuels were observed. Overall, the objectives of the program were met under test conditions which accurately modeled a utility boiler. 16 refs., 45 figs., 14 tabs.

13134 **(NP—7751261) Experimental investigation of the formation of nitrogen oxides in combustion of coal dust. 1st intermediate report covering the period from May 1, 1982 to May 1, 1983.** Kremer, H.; Schulz, W. (Bochum Univ. (Germany, F.R.). Lehrstuhl fuer Energieanlagentechnik). May 1983. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87751261.

In order to make a contribution on the role of combustion of volatile components and the combustion of residual coke in the formation of nitrogen oxide, experiments were done in an electrically heated step combustion chamber with multi-zone control. Complete combustion of the fuel was achieved by post-combustion; after cooling of the stack ags, dust was extracted in a fabric filter. There is a report on the formation of thermal and 'prompt' NO, on the formation of NO from gaseous fuel nitrogen and from residual coke and on burners and firing low in NO/sub x/. Data on measuring technique (characterisation of the fuel, measurement of thermodynamic parameters analytical measuring technique) follow the description of the experimental plant with electrically heated step combistion chamber, air preheater, coal dosing, post combustion and dust extraction and also the air supply. (HWJ).

13135 **(PB—87-116281/XAB) Combustion coal particle temperatures by FT-IR spectroscopy. Final report.** Hamblen, D.G.; Best, P.; Carangelo, R.M.; Solomon, P.R. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 31 Jul 1984. 84p. NTIS, PC A05/MF A01.

The main objective of the work was the development of a method to monitor the temperature of the coal and ash particles. The Phase I program achieved the following results: (1) Emission measurements on a combustion system with good signal-to-noise in 200 milliseconds; (2) A technique using 'normalized' emission spectra was successfully applied to determine particle, ash, soot, and gas temperatures in single- and mixed-phase reacting and non-reacting systems; (3) Measurements on combustion clearly showed differences caused by coal type and the reaction conditions; and (4) Spectral differences related to particle size were identified in the transmission measurements. This suggests the possibility of using the FT-IR technique to determine particle size as well as temperature.

13136 **(SECV-ND—86-022) The effects of combustion conditions on ash and deposits from low rank coals. Volume 2: Yallourn, Morwell, Driffield and Maryvale coals.** Ledger, R.C.; Ottrey, A.L.; Mackay, G.H. (State Electricity Commission of Victoria, Melborune (Australia). Brown Coal Research Div.). 1986. 235p. State Electricity Commission of Victoria, Melborune, Australia. Brown Coal Research Div. Project No. 2402.

This report contains details of combustion tests on four coals from the western side of the Latrobe Valley coalfield. The coals were tested totally or in part at three flame temperatures and two levels of excess oxygen in a 35 kg/hour experimental furnace at the Herman Research Laboratories of the State Electricity Commission of Victoria. Ashes obtained during furnace runs were subjected to some or all of the following processes: chemical analysis; X-ray diffraction; electron microscopy; Moessbauer spectroscopy; infra-red spectroscopy; sinter testing; thermal analysis - differential thermal analysis; thermogravimetric analysis and thermo-mechanical analysis. Deposition tended to increase with increasing flame temperature and level of excess oxygen but it was not a strong tendency with all coals. The mineral species forming the deposits have been determined in more detail than previously and have been related to combustion conditions and composition where possible.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 13122, 13604

13137 **(DOE/EIA—0121(86/3Q)) Quarterly coal report, July-September 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 12 Jan 1987. 127p. NTIS, PC A07/MF A01 - GPO; 1; GPO Dep. File Number DE87004811.

For the period January through September 1986, coal production totaled 671.2 million short tons, a 1.1% increase over the 664.2 million short tons produced during the same period of 1985. Also during January through September 1986: Appalachian and Interior Region coal production increased 3.6 and 6.7%, respectively as compared with January through September 1985; Western Region coal production decreased 6.6% as compared with January through September 1985; the average price of all US coal exports increased slightly, reaching $46.03 per short ton; coal consumption at coke plants decreased 9.8% (3.1 million short tons); and consumer coal stocks at the end of September 1986 were 164.5 million short tons, the lowest end-of-quarter level since the coal-strike-induced figure (158.3 million short tons) for the quarter ending June 1981. The 1.1% increase in coal production for the first 9 months of 1986 versus the comparable period in 1985 was the net result of significant production increases in the Appalachian (11.4 million short tons) and Interior (9.4 million short tons) Regions versus a large decrease in the Western Region (13.7 million short tons). During the first 9 months of 1986, US coal exports totaled 65.1 million short tons, a 5.1% (3.5 million short tons) decrease from their corresponding 1985 level. Most of the decline was due to metallurgical coal exports which fell 2.8 million short tons. US coal exports for the first three quarters of 1986 were valued at $3.0 billion. 13 figs., 62 tabs.

13138 **(DOE/EIA—0502) Coal-exporting countries: The European market.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 13 Jan 1987. 46p. NTIS, PC A03/MF A01 - GPO. File Number DE87004815.

In Western Europe steam coal demand surged from 28 million tons in 1973 to 89 million tons by 1985. The Energy Information Administration projects that this demand will rise further to 125 million tons by 1995. Although US coal has captured a major share of Europe's expanding steam coal market, US market share is not expected to increase in the future in the face of increasing competition. Factors that may influence which exporters will supply Europe's expanding steam coal trade include the price and quality of coal as well as the reliability of supply. Other major coal exporters to Western Europe include South Africa, Australia, and Poland. South Africa supplied 20% of the European market in 1985, and provided the largest share of steam coal imports. Columbia is expected to become a major steam coal supplier to Western Europe. The remaining coal exporters to Western Europe - West Germany, the USSR, the United Kingdom, and Canada - export limited quantities of coal. These countries are not expected to expand their market shares due to either uneconomical mining or shipping costs. This report analyzes the coal industries of the major competitors of the United States in the European market: South Africa, Poland, and Colombia. The structure of their coal industries is examined in terms of coal reserves, production, transportation, trade, and government policies that affect the coal industry. The United States has the capability to supply a major share of Europe's growth in steam coal trade. US coal, however, must compete with competitively-priced supplies of Australian, South African, and Colombian coal. If these countries are able to expand their shares of the European market, prospects for US steam coal will be limited. A shortfall in exports from any of the major coal suppliers, however, could offer an opportunity for the expansion of US coal exports.

13139 **(IEA/ICEAS—E8) Economic potential of coal-water mixtures.** Siemon, J.R. (International Energy Agency Coal Research, London (UK)). Sep 1985. 99p. NTIS (US Sales Only), PC A05/MF A01. File Number TI86900329.

Coal-water mixture (CWM) preparation and combustion is a demonstrated, but not established, technology. The nearest existing competitor for CWM is residual fuel oil (RFO). RFO prices are predicted to remain in the range 4.5 to 5.0 $/GJ (in 1983 US dollars) for the time period 1985 to 1990. Some general escalation (in real terms) of oil prices is likely in the time period 1990 to 1995 and for these prices an RFO price of 5.0 to 5.5 $/GJ has been used. The cost elements for delivered CWM have been examined in detail. Depending on the cost of coal, the process flowsheet, plant size, extent of off-sites and ancillaries required, and plant location, CWM is estimating to cost 2.9 to 4.6 $/GJ. Data on industrial and utility boiler populations, and the costs of conversion to CWM and other fuels are generalized to a form suitable for economic analysis. The potential for CWM as a utility boiler fuel has been examined on a country-to-country basis. A total RFO replacement of 16.5 Mt/a is predicted - two-thirds of which is in the US, the remainder in Japan, Italy and Canada. Overall, a replacement of 10% of present RFO consumption is projected to be economic. This represents a potential market of 60 Mt/a for CWM - 50% of which is for electric power generation and 40% for steam raising in the industrial and commercial sectors. 95 refs., 66 figs., 37 tabs.

0160 Health And Safety

REFER ALSO TO CITATION(S) 13119, 13120

13140 **(PB—87-104725/XAB) NIOSH (National Institute for Occupational Safety and Health) certified equipment list as of October 1, 1985.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1985. 371p. (DHHS/PUB/NIOSH—86-101). NTIS, PC A16/MF A01.

The NIOSH certified equipment list of coal-mine-dust personal sampler units and respiratory protective devices updated to October 1, 1985 is presented. The publication was prepared by the Certification Branch (CB), Division of Safety Research, NIOSH.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 13112

02 PETROLEUM

0201 Reserves

13141 **(BMI/ONWI—621-Vol.1) Petroleum potential of two sites in Deaf Smith and Swisher Counties, Texas Panhandle: Volume 1: Technical report.** Rose, P.R. (Telegraph Exploration, Inc., TX (USA); Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1986. Contract AC02-83CH10140. 67p. NTIS, PC A04/MF A01. File Number DE87004783.

This is the third in a series of regional geologic studies to assess the petroleum resources of two potentially acceptable sites under study for a nuclear waste disposal facility. Site 1 is in northeastern Deaf Smith County, Texas, and Site 2 is in northeastern Swisher County, Texas. Although potential reservoir zones are present under Site 1, the likelihood of hydrocarbon charge and structural or stratigraphic entrapment is low. The probability of a commercial petroleum discovery is estimated at 1:1000, and expected net present value of potential production is about $700,000. Little future industry drilling activity is foreseen around Site 1. Five potential reservoir zones are present under Site 2, and some may contain hydrocarbons. Anticlines are adjacent to Site 2, and some may contain hydrocarbons. Anticlines are adjacent to Site 2 on the northeast, southeast, and northwest, but the middle of the acreage block is synclinal, and its petroleum potential is very low. Discovery probability of the structures adjacent to Site 2 is higher, but the chance of developing commercial production is only about 2:100. Such accumulations might extend into the northeast and southeast corners of the block; expected net present value of such conjectured reserves is about $1,100,000 and $650,000, respectively. Continued industry activity pursuant to these three structures is expected, including seismic surveys and drilling. Considering the potential loss of petroleum resources through withdrawal of acreage from exploration, and the possibility of adjacent drilling, Site 1 in Deaf Smith County is clearly preferable for location of the proposed nuclear waste disposal facility.

13142 **(BMI/ONWI—621-Vol.2) Petroleum potential of two sites in Deaf Smith and Swisher Counties, Texas Panhandle: Volume 2, Exhibits: Technical report.** Rose, P.R. (Telegraph Exploration, Inc., TX (USA); Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1986. Contract AC02-83CH10140. 98p. NTIS, PC A05. File Number DE87004784.

13143 **(DOE/EIA—0370(86)) Oil and gas field code master list, 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 7 Jan 1987. 644p. NTIS, PC A99/MF A01 - GPO; 1; GPO Dep. File Number DE87004338.

This fourth annual listing of all identified oil and gas fields in the United States with updated field information collected through November 1986 provides codes for easy identification of domestic fields. Standardization on these field codes fosters consistency of field identification by government and industry. The use of field names and codes listed in this publication is required on survey forms and other reports regarding field-specific data collected by the Energy Information Administration and the Federal Energy Regulatory Commission. A glossary of key terms is provided.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 13167, 13195, 14350

13144 **(ETN—6-97256) Petrophysical quantities from high resolution gamma-ray spectra arising from energetic neutron bombardment.** Mellor, D.W.; Underwood, M.C. (British Petroleum Co. Ltd., Sunbury-on-Thames). 1985. 27p. (CONF-8506104—4). NTIS HC A03/MF A01.

From 26. Society of Professional Well Log Analysts annual logging symposium; Dallas, TX, USA (17 Jun 1985).

A logging tool comprising a 5 Curie Am241-Be neutron source and n-type intrinsic germanium gamma ray detector was developed. A large calibration tank, in simulated well-bore geometry, comprising oil and water saturated sand, was constructed and was interrogated using the tool. In a separate experiment, oil zone material was irradiated using 14 MeV neutrons. An interpretational model that allows the porosity, oil and water saturation, matrix composition, and water salinity to be inferred is presented. This confirms that under strictly controlled experimental conditions, major petrophysical properties can be inferred from high resolution gamma ray spectra.

13145 **(GRI—86/0127) Analysis of the regional distribution of vanadium in petroleum: Final report, July 1985-April 1986.** Marland, G.; Wang, G.C. (Oak Ridge Associated Universities, Inc., TN (USA); Gas Research Inst., Chicago, IL (USA)). Oct 1986. Contract AC05-76OR00033. 77p. NTIS, PC A05/MF A01. File Number DE87004875.

It has been suggested that the regional distribution of vanadium in crude oil may provide information on the origin of natural gas and petroleum deposits on earth. If there are regional patterns in the concentration which are large in scale and unrelated to sedimentary or tectonic environments, this may support the theory that economically important quantities of abiogenic hydrocarbons are migrating from deep in the earth. This report documents all of the vanadium data found in the open literature and examines the local and regional variations in concentration. It is shown that much of the variability is a consequence of the fact that vanadium is concentrated in the heavy fractions of oils and in heavier oil. On a local scale, variations in vanadium can be further related to sedimentary, structural, or migrational phenomena. On a regional scale it is clear that there are large regions which are characterized by high or low vanadium concentrations. While there are not enough data available to be definitive, it does not appear that these regions transcend traditional depositional or tectonic environments. 93 refs., 27 figs., 15 tabs.

13146 **(PB—87-107405/XAB) Gulf of Mexico physical-oceanography program final report: years 1 and 2. Volume 1. Executive summary. Technical report, 1983-1985.** (Science Applications International Corp., Raleigh, NC (USA)). Feb 1986. 23p. (SAIC—86/1022). NTIS, PC A02/MF A01.

In 1982, Minerals Management Service (MMS) initiated a multi-year program under contract with Science Applications International Corp. (SAIC) to study the physical oceanography of the Gulf of Mexico as part of its outer continental shelf environmental-studies programs. This particular program, called the Gulf of Mexico Physical Oceanography Program (GOMPOP), has two primary goals: (1) develop a better understanding and description of conditions and processes governing Gulf circulation; and (2) establish a data base that could be used as initial and boundary conditions by a companion MMS-funded numerical circulation-modeling program. The report presents results from the first two of three years of observations in the eastern Gulf.

13147 **(PB—87-107413/XAB) Gulf of Mexico physical oceanography program final report: years 1 and 2. Volume 2. Technical report. Report for 1983-1985.** (Science Applications International Corp., Raleigh, NC (USA)). Feb 1986. 408p. (SAIC—86/1023). NTIS, PC A18/MF A01.

In 1982, Minerals Management Service (MMS) initiated a multi-year program under contract with Science Applications International Corp. (SAIC) to study the physical oceanography of the Gulf of Mexico as part of its outer continental shelf environmental-studies program. The program has two primary goals: (1) develop a better understanding and description of conditions and processes governing Gulf circulation; and (2) establish a data base that could be used as initial and boundary conditions by a companion MMS-funded numerical-circulation modeling program. The report presents results from the first two of three years of observations in the eastern Gulf.

13148 **Experimental study of the reaction of methane with petroleum hydrocarbons in geological conditions.** Gold, T.; Gordon, B.E.; Streett, W.; Bilson, E.; Patnaik, P. (Cornell Univ., Ithaca, NY). *Geochimica et Cosmochimica Acta;* **50**: No. 11, 2411-2418(Nov 1986).

In order to assess the possible role of methane in petroleum formation, they studied the reaction of methane with liquid hydrocarbons representing the three main classes of compounds dominant in crude oil. The experimental reaction conditions simulated those of a geological setting for petroleum formations, at 1000 atm and 150-250°C in the presence of montmorillonite, a natural clay catalyst. Since they expected very slow reaction rates and thus low yields, we used ^{14}C labeled methane to trace the reaction products. They report here the detection of ethylbenzene and ethyltoluene formed by the interaction of methane with benzene and toluene, respectively. Instead of methylation of benzene, predominantly C_2 addition occurred, although very small amounts of products corresponding to C_1 addition were also detected. They propose that catalytic dissociation of methane occurred, forming ethylene which participated in a Friedel-Crafts type alkylation process of the aromatic ring on the catalyst surface. In addition to ring alkylation, side reactions such as polymerization of unsaturates (ethylene, acetylene) appeared to have occurred on the catalyst surface. The nature of these polymers is yet to be determined.

13149 **Modelling the electrical response of sandstones with an equivalent circuit.** Knight, R.J.; Nur, A.; Raistrick, I.D. (Stanford Univ., Stanford, CA 94305). pp 1-17 of Transactions of the SPWLA 26th annual logging symposium. Houston, TX; Society of Professional Well Log Analysts, Inc. (1985). (CONF-8506104—).

From 26. Society of Professional Well Log Analysts annual logging symposium; Dallas, TX, USA (17 Jun 1985).

Complex impedance data have been collected for 13 sandstones at various levels of saturation with deionized water across the frequency range of 10 kHz to 13 MHz. These data can be fit very well with the equivalent electrical circuit proposed elsewhere. The circuit is composed of a parallel RC circuit where the resistor corresponds to the d.c. resistance of the sample and the capacitor corresponds to the high frequency or dipolar capacitance of the sample. In parallel with this circuit is a complex admittance parameter which models all the superimposed frequency dependence of the system. A numerical inversion program using a nonlinear least squares technique is used to invert the data. All data can be modelled with this circuit with a root mean square error of less than 2%. By using this circuit to model the impedance data from sandstones it is possible to extract both the d.c. resistance and the dipolar capacitance from data collected in the kHz range. In addition to determining these resistance and capacitance values, modelling with this equivalent circuit defines a complex admittance parameter which may prove to be a very useful indicator of rock properties. The complex admittance term contains real and imaginary parts exhibiting the same power law dependence upon frequency. The value of the power law exponent has been found to be closely related to the surface area to volume ratio of the pore space.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 13186

13150 (DOE/BC—86/2/SP, pp 14.1-14.14) **Cross borehole probing for petroleum reservoir assessment.** Laine, E.F.; Lytle, R.J. (Lawrence Livermore National Lab., CA). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278. Contract W-7405-ENG-48.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

A review of the history of developments of the "enhanced oil recovery monitoring program" conducted by Lawrence Livermore National Laboratory (LLNL) is presented. Beginning in 1976, LLNL began developing a remote probing technology based on electromagnetic and seismic cross-borehole probing. Equipment usable in the field environment, signal generating equipment, signal recording equipment and data analysis computer programs were developed from 1976 to present. Testing has gone on at the Kern River oil field near Bakersfield, CA which is being steamflooded.

13151 (DOE/BC—86/2/SP, pp 15.1-15.49) **Seismic imaging for thermal EOR monitoring.** Nur, A.; Quinn, B.A. (Stanford Univ., CA). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

This report describes the history and activities of Stanford Rock Physics in connection with seismic location of injected steam at the Intevep-sponsored project in Maraven's M-6 steam drive project east of Ciudad Ojeda, Aulia, Venezuela. Project history has also been included, and conclusions and recommendations are given.

13152 (DOE/BC—86/2/SP, pp 16.1-16.11) **Thermal front tracking.** Chacin, O. (INTEVEP, S.A., Caracas, Venezuela). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

Seismic methods for tracking steam flooding fronts in enhanced oil recovery are briefly discussed. A short literature survey on the subject is given, along with a review of the INTVEP field test analysis, and recommendations for future work.

13153 (DOE/BC—86/2/SP, pp 17.1-17.46) **Field experiment of improved steam drive with in situ foaming.** Marcou, J.A.; Brigham, W.E.; Castanier, L.M.; Sanyal, S.K.; Malito, O.P.; Strom, J. (Stanford Univ., CA). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278. Contract AC03-80SF11445.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

A discussion of the Stanford University Petroleum Research Institute (SUPRI) research project is presented. It is aimed at improving the recovery efficiency of steam drive projects by reducing gravity override and channeling. The SUPRI field experiment is located in the Kern River field near Bakersfield, CA. The experimental was set on two fully-developed 5-spot patters. One was to serve as experimental control and the other was to be tested with a surfactant solution. Results of the experiment indicated that production would increase about one month after the surfactant slug injection and would last for about five or six months.

13154 (DOE/BC—86/2/SP, pp 17.70-17.75) **Foam flow in porous media studies.** Treinen, R. Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

An apparatus for the measurement of the apparent viscosity of foam (gas and surfactant solution) in porous media is discussed. Surfactant flow rates are controlled by a constant pump rate, while a mass flow controller is used for the gas flow rates. Transducers are used to measure differential pressures across three sections of the sand pack.

13155 (DOE/BC—86/2/SP, pp 17.76-17.93) **Study of heat transfer of steam injection and effect of surfactants on steam mobility reduction.** Wang, F. Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

A technique for calculating the steam swept volume using Marx and Langenheims's equation is presented. Also examined is the heat transfer of steam injection in a linear tubular core with two layers of insulation. In addition, the effects of Suntech IV solution of steam mobility reduction are discussed. The main factors studied were concentration, size and number of slugs of surfactant solution, and back pressure.

13156 (DOE/BC—86/2/SP, pp 17.94-17.106) **2-D glass model.** Mahmood, S. Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

This report outlines attempts of physical and mathematical modeling of gas-surfactant simultaneous flow through porous media under conditions where foam forms over only a portion of the model.

13157 (DOE/BC—86/2/SP, pp 18.1-18.63) **Properties of anionic surfactants and their use as diverting agents.** Ziritt, J.L.; Rancel, C.; Paz, F. (INTEVEP, S.A. Caracas, Venezuela). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

Steam drive is the most successful of all enhanced recovery processes, but it has not been without problems. Channeling through highly permeable zones and gravity override of steam has lead to early steam breakthrough at the production wells. Steam foams have proven effective as permeability blocking agents in steam flooding. This study is part of a research program oriented to develop the necessary knowledge to encourage the application of steam with foaming agents in the field. Foaming agents (surfactants) were investigated for their longevity under steam injection conditions. Adsorption on sand as well as partitioning between water and oil phase were also studied. Surfactants were evaluated under dynamic conditions using one-dimensional and two-dimensional sand packs.

13158 (DOE/BC—86/2/SP, pp 19.1-19.31) **Fourth SPE comparative solution project - a comparison of steam injection simulators.** Aziz, K.; Ramesh, A.; Woo, P.T. Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

Three related steam injection problems are presented along with simulation results for them. The first problem deals with three cycles of cyclic steam injection, and the other two problems deal with steam displacement in an inverted nine-spot patter.

13159 (DOE/BC—86/2/SP, pp 20.1-20.4) **High temperature downhole instrumentation.** Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

A discussion of well logging and monitoring probes for use in the high temperature steam injection process is presented. Multipurpose tools are compared to single purpose tools as are multiconductor wirelines versus single conductor wirelines.

13160 (DOE/BC—86/2/SP, pp 21.1-21.10) **Corrosion prevention.** Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

Metallurgical analyses of field test specimens of downhole steam generators (DSGs) and recommendations are made for making the DSGs more corrosion resistant.

13161 (DOE/BC—86/2/SP, pp 22.1-22.27) **Deep reservoir steam injection technology: feasibility study of potential pilot test in Venezuela.** Manzano-Ruiz, J.J. (INTEVEP, S.A., Caracas, Venezuela). Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

The technical feasibility of a steam injection project at a deep reservoir in Boscan field in western Venezuela is presented. The computer program, WELMOD was used to simulate the two-

phase steam/water mixtures in downward flow. Four hypothetical cases are given.

13162 (DOE/BC—86/2/SP, pp 23.1-23.3) **Petroleum Extraction Simulation Lab (PESL): tentative experimental program plan.** Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

The Petroleum Extraction Simulation Laboratory (PESL) is a facility designed to allow simulations of petroleum extraction processes at realistic pressures and temperatures (up to 1200 psi and 675° simultaneously, or up to 1600° at atmospheric pressure.) A tentative research and development plan for the facility is given.

13163 (DOE/BC—86/2/SP, pp 24.1-24.4) **Current status of commercial downhole steam generators.** Mar 1986. NTIS, PC A16/MF A01. File Number DE86000278.

In Second amendment and extension to Annex IV enhanced oil recovery thermal processes.

In the late 1970's and early 1980's several companies entered into the downhole steam generator business. Information regarding field test experiences and current design status of this endeavor by the companies involved is summarized.

13164 **(NIPER—146) Mobility control in oil recovery by chemical flooding: State-of-the-art review: Topical report.** Gao, H.W. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract FC22-83FE60149. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87001210.

Mobility control in oil recovery by chemical flooding (polymer, micellar-polymer, and alkaline-polymer) can be achieved through the use of low-concentration water-soluble polymers in water or in chemical slugs. Since the late 1950's, water-soluble polymers have been studied extensively in laboratories by many researchers and widely used in many chemical flooding projects to improve sweep efficiency and increase ultimate oil recovery. Effective use of polymers as mobility control agents requires the understanding of the stability of polymers and their rheological behavior in reservoirs. An overview of the scientific literature on the application of water-soluble polymers in enhanced oil recovery (EOR) is presented. The processes, factors, and mechanisms that influence the stability of polymers and those that cause a reduction in water mobility are discussed. Existing knowledge of polymer flow behavior in porous media, and of surfactant-polymer interactions is reviewed. Also discussed are the case histories of 23 chemical flooding field projects. 177 refs., 6 figs., 5 tabs.

13165 **(NIPER—206) A simple mathematical model for estimating mineral-alkali reactions in alkaline flooding: Topical report.** Thornton, S.D. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract FC22-83FE60149. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87001211.

The problem of characterizing alkali-water-rock reactions in alkaline flooding is complicated because there are many mineral phases and aqueous species to include in a compositional model. The model presented in this report includes the following types of minerals: silicates, carbonates, sulfates, and oxides. Individual mineral reactions are arranged in order of increasing pH. Sulfate and carbonate minerals are converted to oxides and silicates at intermediate pH. Transformation of silicate minerals into zeolites occurs at high pH. The model predicts that calcium, magnesium, and carbonate ions are most important at neutral to intermediate pH and that silicate and aluminate ions become important at high pH. Results from bottle tests quantify the ability of minerals to consume alkaline agents. Studies on individual minerals, including kaolinite and dolomite, are reported. The effects of individual minerals in a mixture were found to be additive. The results described in this report show that an accurate determination of rock mineralogy is required for a reasonable prediction of alkali consumption in an oilfield. 42 refs., 14 figs., 13 tabs.

13166 **(NIPER—223) Thermodynamic model for surfactant adsorption: Topical report.** Woodbury, G.W. Jr.; Noll, L.A. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract FC22-83FE60149. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87001212.

A simple, semi-empirical thermodynamic model was constructed for the adsorption of solutions of surfactants onto solid surfaces. Essentially a modified finite-layer BET theory, the model is complete in that it predicts all surface thermodynamic properties. The properties of bulk solutions are considered in an exact way, and the availability of bulk thermodynamic properties is assumed. The theory has been applied satisfactorily to both the adsorption isotherm and the heat of adsorption curve for the adsorption of decyltrimethylammonium bromide (DTAB) on silica gel. In this system, the observed adsorption which occurs above the critical micelle concentration (CMC) depends on the detailed behavior of the bulk thermodynamic properties; since the measured surface properties are sensitive to bulk properties, the latter must be accounted for accurately. DTAB is the only reported surfactant system, for which both the isotherm and the heat have been measured and for which the bulk solution properties are known. A critical test of the theory awaits more data of this type; however, the theory has been tested against isotherms measured by Scamehorn, et al., and has been found to fit within experimental error below the CMC. There are many areas in which the adsorption of surfactants is of practical importance such as minerals processing, lubrication, and enhanced oil recovery. The theory should prove useful to all of these areas. In the scope of enhanced oil recovery, this theory is intended to be developed into an adsorption module for a reservoir simulator for surfactant-mineral systems whose behavior is too complex to be modeled by Henry's law or even a Langmuir isotherm. 15 refs., 6 figs., 2 tabs.

13167 **Oil and gas developments in USSR in 1983-1985.** Ulmishek, G.; Harrison, W. (Argonne National Lab., IL). *American Association of Petroleum Geologists, Bulletin;* 70: No. 10, 1566-1577(Oct 1986).

Despite increasing Soviet investment in its petroleum industry, oil production in USSR declined for the first time in the post-World War II period, from 12.327 million b/d in 1983 to 11.9 million b/d in 1985. Although oil production continued to increase in West Siberia, it was not sufficient to offset declines in the old producing regions west of the Urals. In the same period, however, gas production increased sharply, from 18.9 tcf to 22.6 tcf, due mainly to development of the supergiant Urengoy field in West Siberia. Efficiency of exploration continued to decrease in all petroleum regions except offshore in the southern Caspian Sea. In all these regions, the quality of the exploration prospects worsened - smaller and less productive structures were drilled, the average depth of drilling increased, and exploration extended into more remote areas. 4 figures.

0204 Processing

REFER ALSO TO CITATION(S) 13030, 13032

13168 **(DOE/PC/80009—T19) Cooperative research in coal liquefaction infratechnology and generic technology development: Quarterly report, September 1, 1986-December 1, 1986.** Sendlein, L.V.A.; Huffman, G.P. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). 1986. Contract FC22-85PC80009. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004157.

Research in the area of co-processing focused on the demetallization of crude oil by coal. It was demonstrated that other carbonaceous materials, such as activated carbon and char produced from cellulose, also demetallize the oil effectively. Co-processing was also demonstrated to be effective in desulfurization and denitrogenation. Processing coal/oil mixtures (coal:oil = 10:90 to 25:75) for one hour yielded sulfur and nitrogen removals of approximately 50% to the product gas and to the THF insolubles. Vitrinite concentrates were obtained from KY No. 9 and No. 11 coals by density gradient centrifugation. The concentrates, which were greater than 96% vitrinite, were liquefied in microautoclaves at 385, 427,

and 445°C. The maximum conversions, greater than 96%, occurred at 427°C. Liquefaction data have now been obtained for one hundred coals. To date, the best linear correlation with conversion is with total reactive maceral content of the coals. A Retrospective Technology Assessment (RTA) on Direct Coal Liquefaction (DCL) is near completion. Work in this quarter focused on analyzing the evolution of DCL and the failure to commercialize the technology to date. Interviews with a number of major DCL researchers have been and will continue to be conducted, in order to trace knowledge flows and identify knowledge gaps. An AT & T 3B20 computer at the University of Kentucky will be used to host the Consortium database. AT & T personal computers interfaced with the 3B20 will be used for development and management of the Consortium database/network.

13169 **(NIPER—186) Trends in refinery feedstock properties and refining problems: Topical report.** Wells, J.W.; Anderson, R.P. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract FC22-83FE60149. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001214.

Trends in quality of crude feedstocks to US refineries and the problems in processing and utilization caused by the changing feed quality were reviewed. The quality of feedstocks declined in the period 1978 to 1985. This is shown, for example, by declining in API gravity from 34.3 to 32.4 and an increase in sulfur content from 0.78 to 0.91%. The lower quality was due primarily to a decline in quality of imported rather than domestic crudes. The shift in crude quality was not caused by a shortage of conventional crude, but resulted from economic factors which encouraged the utilization of cheaper heavier crudes. While domestic throughput decreased significantly during this period, the fraction of the residual material being upgraded increased. The increased conversion was driven by heavier feedstocks, a sustained demand for distillate products, a decreased demand for residual fuels, and an increased conversion capacity by industry. The majority of the upgrading relied largely on carbon rejection techniques. A variety of problems are associated with the utilization of lower quality feedstocks and increased resid processing. These include both problems in the refinery and problems with product quality. The understanding of fundamental petroleum chemistry of heavy crudes and resids is inadequate to predict their processing behavior. Processing flexibility for resids from heavy crudes is limited due largely to their metals content and propensity for coke formation. Other problems discussed include those with desalting, naphthenic acids, hydrotreating, cat cracking, and thermal operations. The change in feedstock quality and increased resid upgrading did not negatively affect overall gasoline quality, but have negatively affected quality of heavier fuels. Heavier feedstocks and increased resid processing result in more aromatic diesel cuts with poorer diesel ignition quality. 24 refs., 11 figs., 2 tabs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 13189

13170 **(AD-A—173747/7/XAB) Combustion performance of contaminated marine diesel fuels in a T63 gas-turbine combustor. Interim report, November 1983-September 1985.** Naegeli, D.W.; Dodge, L.G. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1985. 123p. (BFLRF—208). NTIS, PC A06/MF A01.

The combustion performance of 26 fuel blends of Navy distillate fuel (NDF), heavy marine gas oil (HMGO), and a Jet A reference fuel contaminated with residuals containing various concentrations of asphaltenes, resins, and ash was measured in a T63 gas turbine combustor rig. Combustion-performance measurements included cold-start ignition, combustion efficiency, gaseous exhaust emissions, flame radiation, exhaust smoke, liner temperature, and combustor can deposit formation. Except for ignition, these measurements were made at 4 operating conditions, 10% of full power (idle), 55, 75, and 100% of full power. Cold-start ignition measurements were made on 9 of the test fuels at burner inlet air temperatures ranging from 238K to 300K and fuel temperatures ranging from 263K to 300K. Droplet-size measurements were made of fuel sprays from the T63, LM2500, DDA 501-K17, and the TF40B atomizers using a Malvern light-scattering apparatus. These measurements were made on 7 fuels over a range of low fuel-flow rates comparable with those used for the ignition conditions of the respective engines. Correlation equations were developed relating Sauter mean-d.oplet diameter to fuel properties and flow conditions. The correlation equation developed for the T63 atomizer was used in a characteristic time-model calculation of the cold-start ignition data. Flame radiation and exhaust smoke correlated with hydrogen-carbon ratio. Fuels contaminated with residuals did not deviate significantly from the H/C ratio correlation. When neat NDF and HMGO were contaminated with residuals, there appeared to be a slight decrease in combustion efficiency and increase in total hydrocarbon and CO emissions.

13171 **(AD-A—173850/9/XAB) Thermal-oxidation stability of diesel fuels. Interim report, October 1983-January 1986.** Stavinoha, L.L.; Barbee, J.G.; Yost, D.M. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Feb 1986. 222p. (BFLRF—205). NTIS, PC A10/MF A01.

Injector fouling bench tests(IFBT) and modified Jet Fuel Thermal Oxidation Test(JFTOT, ASTMD 3241) were used to develop methodology for evaluating the thermal stability of diesel fuels. A new method for measuring the thickness of lacquer-type fuel deposits formed on test surfaces at elevated temperatures was developed and applied to a variety of fuels, both with and without MIL-S-53021(additive stabilizer package). The utility of this technique greatly expands the capability for exploring and defining diesel-fuel thermal stability with respect to both material and kinetic studies. Correlation of IFBT and JFTOT type tests including definitions of temperature, flow, test-surface metallurgy and fuel additive effects can now be performed to better understand diesel thermal stability and provide test methodology/test limit information for fuel-specification consideration.

13172 **(AD-A—173872/3/XAB) Establishment of procedural methodology and data interpretation for fuel-quality evaluation. Interim report, October 1983-September 1985.** Westbrook, S.R.; Stavinoha, L.L.; Owens, E.C.; Bundy, L.L.; Butler, W.E. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Mar 1986. 35p. (BFLRF—212). NTIS, PC A03/MF A01.

This report summarizes the results of a program to monitor fuel-quality and fuel-usage parameters at four test sites. The program was intended to provide baseline data for a demonstration that shale-derived fuels are acceptable for use in aircraft and in ground vehicles and equipment. Fuel samples (diesel or JP-4) were obtained and analyzed for specification conformance. Fuel usage was monitored as was the usage of fuel-wetted components at each test site. Other data obtained included results of the Army Oil Analysis Program (AOAP) and vehicle operational data. Methods of sampling, sample analysis, data analysis, and reporting are discussed. An overview of the results is also presented.

13173 **(AD-A—173894/7/XAB) Sources of error in accelerated stability test methods for diesel fuels. Interim report, October 1983-May 1985.** Lee, G.H.; Stavinoha, L.L. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Jun 1985. 108p. (BFLRF—197). NTIS, PC A06/MF A01.

Ten test methods (including ASTM D 2274) used to determine the accelerated oxidation stability of middle-distillate fuels were reviewed. A critique of various procedures (such as weight and volume measurements) within these test methods was written, including an estimation of which procedural steps had the greatest effect on the final test results. Subsequent laboratory work allowed more-definitive conclusions to be made on the effect of particular preaging, aging, and post-aging procedures on test results using a small set of test fuels. Changes in the particulate filtration procedure and adherent fuel insolubles determination were incorporated into a new test method which was cooperatively round-robin tested. A summary of these data are also included in this report.

Precision data suggest that this method is an improvement over that of the standard D 2274 test method.

13174 **(AD-A—174091/9/XAB) AVGAS/AUTOGAS (aviation gasoline/automobile gasoline) comparison. Wintergrade fuels. Interim report.** Ferrara, A.M. (Federal Aviation Administration, Atlantic City, NJ (USA). Technical Center). Jul 1986. 59p. (DOT/FAA/CT—86/21). NTIS, PC A04/MF A01.

This report describes dynamometer tests that simulated conditions found in a general-aviation aircraft. In these tests, automobile gasoline was tested and compared with aviation gasoline. The tendency for vapor lock and detonation was measured as a function of gasoline grade, Reid vapor pressure, and the age of the fuel.

13175 **(AD-A—174128/9/XAB) Carbon-slurry secondary atomization. Interim report, August 1984-February 1986.** Longanbach, J.R.; Levy, A.; Law, C.K. (Battelle Columbus Div., OH (USA)). Sep 1986. 64p. NTIS, PC A04/MF A01.

Various agents that might be incorporated with the carbon and/or with the JP-10 phase of the slurry for their ability to cause micro-explosions in slurry droplets on heating (and to develop a method to observe and evaluate the behavior using laser radiation as the energy source for explosion initiation) were screened. Experimental investigations were conducted on effect of additives in inducing and intensifying microexplosion of combusting carbon-slurry droplets. A new droplet generator capable of producing small droplets of well-controlled size was developed for the slurry fuel used. Agglomerate fragments produced through microexplosion were collected by using an impactor-type sampling probe and statistically analyzed. Results show that the fragment sizes follow the log-normal distribution, and that addition of 5% volatile miscible fuels to the carbon slurry can significantly reduce the mean fragment size.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 13604, 13613

13176 **(DOE/EIA—0487(85)/2) Petroleum marketing annual, 1985: Volume 2.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 11 Dec 1986. 399p. NTIS, PC A17/MF A01 - GPO; 1; GPO Dep. File Number DE87004340.

Statistical data are compiled on a variety of crude oils and refined petroleum products. Crude oil purchase price and percentage statistics and refined petroleum products sales statistics include data and corrections received after publication. The first volume contains annual price, volume, and percentage statistics. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for refined petroleum products include motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane.

13177 **(FRNC-TH—2247) Present situation and prospects of Mexican petroleum industry.** Baez-Cantellano, R. (Grenoble-1 Univ., 38 (France)). Dec 1983. 437p. (In French). NTIS (US Sales Only), PC A19. File Number DE87750947.

The aim of this thesis was to examine the Mexican oil policy and the evolution of the national oil industry, in order to evaluate its management and position conditions and propose some new elements for a global strategy for the PEMEX state society. An analysis of the economical, political and social aspects of the oil industry in the seventies and their relations with the rest of the Mexican economy is conducted: effects of the oil boom, growth of the oil domination over the general economic behaviours, effects of the subsequent oil market regression and oil price cutdowns in 1981. A precise study of the various sectors, of the PEMEX industry (hydrocarbon production, refining, distribution, ...) is presented, while taking into account the international market evolution, the PEMEX commercial strategy, financial management and fiscality, an evaluation of the Mexican oil industry and recommendations for its strategy are given.

13178 **(NP—7751163) Gasoline service stations.** (ESSO A.G., Hamburg (Germany, F.R.)). 1985. 8p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751163.

The paper abstracted discusses the development of gasoline service stations compared with that of automobiles registered in the Federal Republic of Germany. The structural change started in the late 60s has been characterized by gasoline sales concentrating on a small number of efficient service stations. The paper deals with the development of gasoline sales and gasoline prices, with the economy of service stations and with the fuel supply of the Federal Republic of Germany.

13179 **(OCS/MMS—86-0084) Gulf of Mexico summary report/index, November 1984-June 1986: Outer Continental Shelf oil and gas activities in the Gulf of Mexico and their onshore impacts.** Risotto, S.P.; Collins, J.H. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). 1986. 132p. Minerals Management Service, 1951 Kidwell Dr., MS 642, Suite 601, Vienna, VA 22180. File Number TI87900414.

The Outer Continental Shelf Oil and Gas Information Program of the Minerals Management Service has published two types of documents (summary reports and indexes) to describe oil- and gas-related activities in each of the Outer Continental Shelf regions. In an effort to cut printing costs, the two documents have been combined to eliminate any overlap of information. This Gulf of Mexico Summary Report/Index is the first in the Gulf series to provide the consolidated data within one publication. The new format has two basic sections: (1) a narrative review of Outer Continental Shelf oil and gas activities occurring during a specified time period and (2) an appendix containing information previously provided in the index series, including a review of leasing procedures, a list of selected MMS programs, and a list of Federal and State agencies with OCS oil- and gas-related responsibilities. Most of the illustrations and sale-specific leasing information found in previous Gulf of Mexico Indexes have been incorporated into appendix D of this Gulf of Mexico Summary Report/Index. Appendixes A and B of the previous summary reports, which discussed offshore-related issues and environmental studies, remain as appendixes B and C, respectively, in the second section of this document. The information on Gulf of Mexico OCS orders, OCS standards and operating procedures, OCS statistical summaries, and on the availability of Federal documents, formerly contained in appendix D of the Gulf of Mexico Indexes, is not included in this document. Selected bibliographies have been included, where appropriate, for readers seeking additional information. The last Gulf of Mexico Index included leasing information for August 1983 through October 1984. This document includes data from November 1, 1984 through June 30, 1986. 13 figs., 28 tabs.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 13957

13180 **(MMS—86-0127-Vol.2) Proposed 5-year Outer Continental Shelf oil and gas leasing program, mid-1987 to mid-1992: Final environmental impact statement: Volume 2.** (Minerals Management Service, Washington, DC (USA)). Jan 1987. 976p. Minerals Management Service, 18th and C Streets, NW, Washington, DC 20240. File Number TI87900478.

This final environmental impact statement considers adoption of a proposed 5-year (Mid-1987 to Mid-1992) Outer Continental Shelf (OCS) oil and gas leasing schedule of 41 oil and gas lease sales in 21 planning areas on the OCS. The proposed schedule consists of 4 sales in the Atlantic Region, 12 sales in the Gulf of Mexico Region, 6 sales in the Pacific Region, 15 sales in the Alaska Region, and 5 small annual supplemental sales. Ten other alternatives and summaries are also described. Impacts to the environment could be caused by oil spills, discharges of drilling fluids, muds, cuttings, formation waters, sanitary wastes, and emissions of pollutants from platforms, refineries and well blowouts. Additional impacts could be caused by physical alteration of the seafloor, land use competition, and social and economic disruption in affected coastal areas. States which could be affected by the proposed

action are: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, California, Oregon, Washington, and Alaska. Contents of Volume 2 include: (1) environmental consequences by planning area - western Gulf of Mexico, central Gulf of Mexico, eastern Gulf of Mexico, Washington and Oregon, northern California, central California, southern California, Kodiak, Cook Inlet, Shumagin, North Aleutian, St. George, Navarin Basin, Norton, Hope Basin, Chukchi, Beaufort, and Straits of Florida; (3) consultation and coordination; (3) references; and (4) principal preparers.

13181 (MMS—86-0127-Vol.3) **Proposed 5-year Outer Continental Shelf oil and gas leasing program, mid-1987 to mid-1992: Final environmental impact statement: Volume 3.** (Minerals Management Service, Washington, DC (USA)). Jan 1987. 736p. Minerals Management Service, 18th and C Streets, NW, Washington, DC 20240. File Number TI87900479.

This final environmental impact statement considers adoption of a proposed 5-year (Mid-1987 to Mid-1992) Outer Continental Shelf (OCS) oil and gas leasing schedule of 41 oil and gas lease sales in 21 planning areas on the OCS. The proposed schedule consists of 4 sales in the Atlantic Region, 12 sales in the Gulf of Mexico Region, 6 sales in the Pacific Region, 15 sales in the Alaska Region, and 5 small annual supplemental sales. Ten alternatives and summaries are also described. Impacts to the environment could be caused by oil spills, discharges of drilling fluids, muds, cuttings, formation waters, sanitary wastes, and emissions of pollutants from platforms, refineries and well blowouts. Additional impacts could be caused by physical alteration of the seafloor, land use competition, and social and economic disruption in affected coastal areas. States which could be affected by the proposed action are: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, California, Oregon, Washington, and Alaska. Volume 3 contains appendices for: (1) impact level definitions; (2) air quality regulations; (3) alternative energy; (4) glossary; (5) abbreviations and acronyms; (6) environmental studies; (7) memorandum of understanding between the Environmental Protection Agency and the Department of Interior on discharges; (8) memorandum of understanding between the Department of Defense and the Department of Interior on multiple use conflicts; (9) steps in offshore leasing for standard sales; (10) lease stipulations used in Sales 73 (central California) and 80 (southern California; (11) exploration and development assumptions; and (12) letters of comment.

13182 (N—87-10263, pp vp) **Feasibility experiments on time-resolved fluorosensing applied to oil slicks.** Camagni, P.; Colombo, G.; Koechler, C.; Pedrini, A.; Omenetto, N.; Rossi, G. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The introduction of time resolved observations can provide a very penetrating tool in the practice of laser fluorosensing. The investigations have demonstrated a relevance of multispectral, time resolved analysis for oil fingerprinting. By comparative studies on a variety of crude oils and their most significant fractions, it was found that the process of time decay in a composite oil is characterized by a few steps, which are associated with specific components in the medium light range. The average decay times of these pure fractions are markedly differentiated as to absolute values and spectral spread; as a consequence, the corresponding parameters in the resultant crude are quite sensitive to the particular mixture of these components. Measurements of the time response give then a finer discrimination between oil classes, depending on the relative content of certain fractions. Experiments were pursued with an improved fluorosensor facility, in order to test the application of time resolved fluorosensing to remote samples on water.

13183 (PB—87-118352/XAB) **Draft environmental impact statement for proposed Oil and Gas Lease Sales 110 and 112, Gulf of Mexico OCS (Outer Continental Shelf) region.** Reinhardt, J.L.; Rouse, R.M.; Reggio, V. (Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office). Apr 1986. 611p. (MMS/GM/ES—87/001). NTIS, PC A99/MF A01.

The Environmental Impact Statement is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

13184 (PB—87-118360/XAB) **Final environmental impact statement for proposed Oil and Gas Lease Sales 110 and 112, Gulf of Mexico OCS (outer continental shelf) region.** Reinhardt, J.L.; Reggio, V.C.; Gaudry, S.B. (Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office). Nov 1986. 635p. (MMS/GM/ES—87/002). NTIS, PC A99/MF A01.

The Environmental Impact Statement is a description of the impacts of oil and gas activities resulting from these lease sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

13185 (PB—87-121307/XAB) **Computer simulation of the probability that endangered whales will interact with oil spills, Final report.** Reed, M.; Jayko, K.; Bowles, A.; Anderson, E.; Leatherwood, S. (Dunham-Bush, Inc., Harrisonburg, VA (USA)). Oct 1986. 340p. (ASA—84-35). NTIS, PC A15/MF A01.

A numerical model system was developed to assess quantitatively the probability that endangered bowhead and gray whales will encounter spilled oil in Alaskan waters. Bowhead and gray whale migration diving-surfacing models, and an oil-spill-trajectory model comprise the system. The migration models were developed from conceptual considerations, then calibrated with and tested against observations. The distribution of animals is represented in space and time by discrete points, each of which may represent one or more whales. The movement of a whale point is governed by a random-walk algorithm which stochastically follows a migratory pathway.

13186 (PB—87-121703/XAB) **Integration of suspended particulate matter and oil-transportation study. Interim report.** Kirstein, B.E.; Clayton, J.R.; Clary, C.; Payne, J.R.; McNabb, D. (Science Applications International Corp., La Jolla, CA (USA)). 1 Nov 1985. 76p. NTIS, PC A05/MF A01.

The objective of the oil and suspended-particulate-matter interaction program is to describe and model the fate of oil in the water column when the presence of suspended particulate matter is considered. Oil exists in the water column as discrete droplets or (truly) dissolved oil species. The truly dissolved oil species can be either molecular-specific species or pseudocomponents. The dissolved oil species interact with the suspended particulate by absorbing onto the particle, while the oil droplets interact by colliding with and sticking to the particulate. The concentration of suspended sediment in the water column can be considered as resulting from advection and mixing within the water body and resuspension from the bottom. The former information on sediments from advection and mixing is planned to be derived from a numerical circulation model. The latter information involves a submodel of the bottom boundary layer included as part of the study. The study is one of a series of oil weathering and interactions studies designed to provide the Alaska Outer Continental Shelf (OCS) office with information to assess the effects of OCS oil and gas development.

0230 Properties

REFER ALSO TO CITATION(S) 13030, 13032, 13145, 13169, 13192, 13231

13187 **(DOE/BC/99880—15) Strategic Petroleum Reserve supporting research: FY86 Annual report.** Woodward, P.W.; Shay, J.Y.; Diehl, B.H.; Hornung, K.W.; Doughty, D.A. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract AC22-84BC99880. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001215.

The National Institute for Petroleum and Energy Research (NIPER) provides analytical support to the Strategic Petroleum Reserve Office (SPRO) through a contractual arrangement with the Bartlesville Project Office of the DOE. Work performed during the contract period of this report included establishing new and modifying old methodology for expanded and improved crude oil characterization. The expanded comprehensive characterization scheme that was initiated last year was used to analyze 25 samples of crude oil for the SPRO. Inspection type analyses were performed on 28 SPR crude oil samples. Samples analyzed included cargo samples, cavern samples, and drawdown samples. The number of tests performed for each sample has significantly increased over those done in previous years, and the characterization scheme continues to expand. Accurate characterization data are essential to define and monitor the quality of crude oil in the Strategic Petroleum Reserve, the nation's emergency crude oil reserve. Exploratory research into the chemistry of sludge formation was initiated this past year to provide information for directing future research in this area. Apparently, sludge forms during any long term storage of crude oil and it is present in the SPR caverns. A series of sludge samples were obtained from SPR storage caverns for research and analyses. Some of the samples were separated into acid, base, and neutral fractions using liquid chromatographic techniques. These fractions were further analyzed using a variety of instrumental and chemical methods to yield the elemental and structural information in this report. 5 refs., 13 figs., 10 tabs.

13188 **High-efficiency microcolumn liquid chromatography separation and spectral characterization of nitrogen-containing polycyclics from fossil fuels.** Borra, C.; Wiesler, D.; Novotny, M. (Indiana Univ., Bloomington). *Analytical Chemistry;* 59: No. 2, 339-343(15 Jan 1987). Contract FG02-84ER60215.

Very large polycyclic compounds, with one or more nitrogen atoms in their structures, were separated from fossil fuel samples and characterized spectroscopically. High chromatography were essential to separate such complex mixtures: within structures of 3-10-rings, almost 170 peaks were resolved and over 600 nitrogen polycyclics were spectrally characterized. Most of the structural data were obtained from mass spectroscopy; however, fluorescence emission spectra yielded additional information concerning the shape of molecules.

0240 Storage

REFER ALSO TO CITATION(S) 13187

13189 **(AD-A—174317/8/XAB) Deterioration of fuel stored in the tropics. Final report, November 1982-October 1984.** Chen. (Army Tropic Test Center, APO Miami 34004 (USA)). Oct 1984. 32p. (USATTC—841003). NTIS, PC A03/MF A01.

Automotive gasoline (Mogas), Aviation turbine fuel (JP-4), and Diesel fuel oil (DF-2) were exposed for two years in 55-gallon steel drums at the USATTC Fort Clayton POL Tank Farm. The number of Mogas samples found failing the distillation, unwashed gum content, and color tests increased with increased exposure. Results were basically similar for samples exposed in both shaded and unshaded exposure modes. JP-4 samples exhibited low Reid Vapor Pressure at the end of the test. DF-2 samples did not exhibit any deterioration throughout the test.

13190 **(PB—87-118444/XAB) Approach to evaluating leak-detection methods in underground storage tanks.** Starr, J.; Broscious, J.; Niaki, S. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Oct 1986. 24p. (EPA—600/D-86/242). NTIS, PC A02/MF A01.

The detection and evaluation of leaks in underground storage tanks require a detailed knowledge of conditions both within the tank and in the nearby surroundings. The test apparatus, as constructed, enables data regarding these environmental conditions to be readily obtained and incorporated in a carefully structured test program that minimizes the amount of costly full-scale testing that would otherwise be required to evaluate volumetric leak-detection methods for underground storage tanks. In addition, sufficient flexibility has been designed into the apparatus to enable additional evaluations of non-volumetric test methods to be conducted, and different types of tanks and products to be tested in a cost-effective manner.

0250 Combustion

REFER ALSO TO CITATION(S) 14015, 14275

13191 **(AD-A—173854/1/XAB) Hot-fuel nozzle-fouling test facility. Interim report.** Tyler, J.C.; Wright, B.R. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1985. 22p. (BFLRF—206). NTIS, PC A02/MF A01.

Based on prior testing of turbine engine flow-divider valves and/or fuel-atomizing nozzles, it was concluded that additional nozzle fouling data on both specification and near-specification distillate fuels are needed. The nozzles and fuels of interest would be employed for both Navy shipboard and Navy aircraft applications. Therefore, a hot-fuel nozzle fouling test facility was designed and constructed and is discussed. Also, limited shakedown testing showing the potential of the facility is presented. A test program utilizing four engine-nozzle designs and three middle-distillate fuels having different JFTOT breakpoint temperatures is recommended.

13192 **Heat transfer during laminar flow flame quenching: Effect of fuels.** Huang, W.M.; Vosen, S.R.; Greif, R. (Univ. of California). pp 44 of Proceedings of the 21st symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Wall heat fluxes were obtained in a constant volume combustion chamber for methane-air, ethylene-air and propane-air mixtures. The experiments were performed at pressure near atmospheric over a range of equivalence ratios from 0.8 to 1.2. The unsteady heat fluxes for the three fuels were all correlated by using the heat release rates of the flames prior to quenching and the thermal diffusivity and the flame speed. The calculations were made using a finite difference method and an integral method. Two step chemical kinetics was used in the finite difference calculations and a simplified ignition temperature approach was employed in the integral method. The results from the finite difference calculation were in good agreement with the experimental data. In the integral method, choosing a single value for the dimensionless ignition temperature for all three fuels also yielded good agreement with the experimental data. The maximum wall heat flux accounts for one third of the steady laminar flame heat release rate for three fuels.

13193 **Rate constants for the reactions of ground state atomic oxygen with several olefins.** Smalley, J.F.; Nesbitt, F.L.; Klemm, R.B. (Brookhaven National Lab., Upton, NY 11973). pp 101 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract AC02-76CH00016.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Kinetic investigations of the reactions of 0(/sup 3/P) with other olefins has have now been completed and the results are reported here. The absolute rate data reported here were obtained

using the direct techniques of flash photolysis-resonance fluorescence (FP-RF) and discharge flow-resonance fluorescence (DF-RF). Pseudo-first-order conditions were always maintained in these studies and diagnostic tests were performed to check for secondary reaction complications and perturbations due to possible artifacts specific to features in each apparatus.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 13143, 13200

13194 **(PB—87-133799/XAB) Projections of cost of development of US natural gas potential. Volume 1. Report of study. Final report, June 1981-December 1985.** Kent, H.C.; Gangwar, A.; Guzman, J.; Buell, R.S.; Jensen, C. (Colorado School of Mines, Golden (USA)). Dec 1985. 69p. NTIS, PC A04/MF A01.

The principal objective of the study was to develop a method to evaluate the relative costs of development of the natural-gas-resource potential of the United States estimated by the Potential Gas Committee. The project then calculated such costs of development for those geologic provinces where sufficient data were judged to be available. The calculated relative costs are primarily useful in making comparisons between the costs to be encountered in various geographic areas and at various depths. The costs include the full marginal and the average cost to explore for, find, develop, and produce the postulated gas resource. All costs are relative wellhead costs and have been expressed in constant 1980 dollars. Approximately 82% of the total potential natural gas resource estimated in 1982 to exist by the Potential Gas Committee in the lower 48 states of the United States was included in the analyses of the study. Drilling costs, field size and associated recovery per well, and depth of occurrence of the resource were determined to be the most critical factors affecting the costs of development of the resource.

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 13146, 13147, 13149, 13167, 13194, 13199, 14350

13195 **(AD-A—173620/6/XAB) Geologic development and characteristics of the continental margins, Gulf of Mexico. Research report, 1983-1986.** Coleman, J.M.; Prior, D.B.; Roberts, H.H. (Louisiana State Univ., Baton Rouge (USA). Coastal Studies Inst.). 1986. 7p. (TR—447). NTIS, PC A02/MF A01.

The continental slope of the Gulf Basin covers more than 500,000 sq km and consists of smooth and gently sloping surfaces, prominent escarpments, knolls, intraslope basins, and submarine canyons and channels. It is an area of extremely diverse topographic and sedimentologic conditions. The slope extends from the shelf break, roughly at the 200 m isobath, to the upper limit of the continental rise, at a depth of 2800 m. The most-complex province in the basin, and the one of most interest to the petroleum industry, is the Texas-Louisiana slope, occupying 120,000 sq km and in which bottom slopes range from < 1 deg to > 20 deg around the knolls and basins. The near-surface geology and topography of the slope are functions of the interplay between episodes of rapid shelf-edge and slope progradation and contemporaneous modification of the depositional sequence by diapirism. Development of discrete depocenters throughout the Neogene results in rapid shelf-edge progradation, often in excess of 15-20 km/my. This rapid progradation of the shelf edge leads to development of thick wedges of sediment accumulation on the continental slope. Oversteeping, high pore pressures in rapidly deposited soft sediments and changes in eustatic sea level cause subaqueous slope instabilities such as landsliding and debris flows. Large scale features such as shelf edge separation scars and landslide related canyons often results from such processes.

13196 **(CONF-860567—5) Effects of pore water distribution and stress on the laboratory measurement of tight sandstone properties.** Chowdiah, P. (Institute of Gas Technology, Chicago, IL (USA)). 1986. Contract AC21-83MC20342;FG21-85MC22000. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003950.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

Current laboratory practice for tight sandstone core analysis has come to rely on certain "short-cut" techniques in the interests of reduced cost and experimentation time. Data obtained using two such techniques, mercury porosimetry and gas phase relative permeability determinations with evaporation as the desaturating mechanism, have been studied in conjunction with data along a true drainage path at in-situ net stress in order to enhance the ability to use laboratory results to extract meaningful information relevant to flow in the reservoir matrix. 10 refs., 11 figs., 3 tabs.

13197 **(CONF-860567—6) Porosity and permeability of eastern Devonian gas shale.** Soeder, D.J. (Institute of Gas Technology, Chicago, IL (USA)). 1986. Contract AC21-83MC20342. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003949.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

High-precision core analysis has been performed on eight samples of Devonian gas shale from the Appalachian Basin. Seven of the core samples consist of the Upper Devonian age Huron Member of the Ohio Shale, six of which came from wells in the Ohio River valley, and the seventh from a well in east-central Kentucky. The eighth core sample consists of Middle Devonian age Marcellus Shale obtained from a well in Morgantown, West Virginia. The core analysis was originally intended to supply accurate input data for Devonian shale numerical reservoir simulation. Unexpectedly, the results have also shown that there are a number of previously unknown factors which influence or control gas production from organic-rich shales of the Appalachian Basin. The presence of petroleum as a mobile liquid phase in the pores of all seven Huron Shale samples effectively limits the gas porosity of this formation to less than 0.2%, and permeability of the rock matrix to gas is less than 0.1 microdarcy at reservoir stress. The Marcellus Shale core, on the other hand, was free of a mobile liquid phase and had a measured gas porosity of approximately 10% under stress with a fairly strong "adsorption" component. Permeability to gas (K/sub ∞/ was highly stress-dependent, ranging from about 20 microdarcies at a net stress of 3000 psi down to about 5 microdarcies at a net stress of 6000 psi. The conclusion reached from this study is that Devonian shale in the Appalachian Basin is a considerably more complex natural gas resource than previously thought. Production potential varies widely with geographic location and stratigraphy, just as it does with other gas and oil resources. 15 refs., 8 figs., 3 tabs.

13198 **(DOE/FE/60600—T10) Olig sand, shallow oil zone, Elk Hills Field, Kern County, California: General reservoir study.** (Evans, Carey and Crozier, Bakersfield, CA (USA)). 1 Aug 1986. Contract AC01-85FE60600. 240p. NTIS, PC A11. File Number DE87004294.

The Olig Sand Reservoirs, classified as part of the Shallow Oil Zone, were studied and evaluated. The reservoirs are located in Section 30R, T30S, R23E and Section 24Z, T30S, R22E, M.D.B. and M., all in Elk Hills Oil Field, Naval Petroleum Reserve No. 1, Kern County, California. The three productive reservoirs studied cover an area of 255 acres, and originally contained 3311 MMCF of gas condensate in 4292 acre-feet of sand. The main reservoir, Fault Block I in Section 30R, has been on production since 1982 and is largely depleted. The reservoirs around wells 324-30R and 385-24Z should still be in a virgin state. They can be depleted either through those wells, when their service as Stevens Zone producers is completed, or by twin well replacements drilled specifically as Olig Sand completions. Thirty-six exhibits have been included to present basic data and study results in a manner that will enhance the readers's understanding of the reservoirs. These exhibits include six maps in the M-series, six sections in the S-Series, and fourteen figures in the F-Series, as well as ten tables. The Appendix includes miscellaneous basic data such as well logs, core analyses,

pressure measurements, and well tests. The Calculations Section of the report develops and explains the analytical methods used to define well productivity, determine reserves, and schedule future production of those reserves. Although no MER recommendations have been made for these gas condensate reservoirs, recommended depletion schemes and schedules are presented. These schemes include one eventual recompletion and one new well to maximize present worth of these reservoirs which carry proved reserves of 289 MMCF and probable reserves of 853 MMCF, effective August 1, 1986. In addition, potential future testing is earmarked for wells 322-30R and 344-30R. 11 refs., 14 figs., 10 tabs.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 13167, 13198

13199 **(PB—87-101028/XAB) Coordination of geological and engineering research in support of Gulf Coast co-production program. Annual report, August 1, 1985-May 31, 1986.** Light, M.P.R.; Jackson, M.L.W.; Ayers, W.B. (Texas Univ., Austin (USA). Bureau of Economic Geology). May 1986. 277p. NTIS, PC A13/MF A01.

Gas fields with co-production potential in the Gulf Coast were selected and evaluated; 150 gas fields were reviewed and 25 were selected, of which Port Acres, Ellis, and Esther fields were evaluated.

13200 **(PB—87-127734/XAB) Projections of cost of development of US natural gas potential. Volume 2, appendices. Final report, June 1981-December 1985.** Kent, H.C.; Gangwar, A.; Guzman, J.; Buell, R.S.; Jensen, C. (Colorado School of Mines, Golden (USA)). Dec 1985. 414p. NTIS, PC A18/MF A01.

The principal objective of the study was to develop a method to evaluate the relative costs of development of the natural gas resource potential of the United States estimated by the Potential Gas Committee. The project then calculated such costs of development for those geologic provinces where sufficient data were judged to be available. The calculated relative costs are primarily useful in making comparisons between the costs to be encountered in various geographic areas and at various depths. These relative cost data also provide the basis for making meaningful comparisons between the costs of alternate sources of natural gas and other energy sources. The costs include the full marginal and the average cost to explore for, find, develop and produce the postulated gas resource. All costs are relative wellhead costs and have been expressed in constant 1980 dollars. Approximately 82% of the total potential natural gas resource estimated in 1982 to exist by the Potential Gas Committee in the lower 48 states of the United States was included in the analyses of the study. Drilling costs, field size, and associated recovery per well, and depth of occurrence of the resource were determined to be the most critical factors affecting the costs of development of the resource.

13201 **(PB—87-134078/XAB) Seismic detection of fractured Devonian shale reservoir. Annual report, July 1985-June 1986.** Wilson, T.H.; Shumaker, R.C.; Sims, C.S. (West Virginia Univ., Morgantown (USA). Dept. of Geology). Jul 1986. 103p. NTIS, PC A06/MF A01.

Interpretation of seismic data over the Cottageville gas field in West Virginia reveals the presence of numerous changes in reflection character across the top of the Lower Huron shales. Production from the Lower Huron is fracture-controlled, and some of the more-pronounced changes in amplitude and shape occur in the more-productive areas of the field. Model studies indicate that these changes are related to the development of low-impedance intervals that extend into the overlying shales of the Middle Huron. Analysis of geophysical logs indicates that these differences are not produced by lithologic variability in the shale. Hence, the observed changes in reflection character are believed to be associated with intense fracturing. Studies here suggest that the analysis of seismic data can be combined with other data to reduce the risk associated with exploration and development of Devonian shale gas resources. Final open-flow of gas and geologic structure from >4000 shale gas wells in eastern Kentucky outlines two high-flow areas. Interrelationships between geologic structure and gas flow are direct in one, but they are complex and unresolved in the other. Linear, steep flow gradients and the interrelationships of high-flow to structure confirm the importance of tectonic fracture permeability to shale productivity.

0304 Products And By-products

REFER ALSO TO CITATION(S) 13341

13202 **(CONF-8604218—3) Video-based training program for LNG plant personnel.** Bukacek, R.F.; Anderson, P.J.; Raines, J.T. (Institute of Gas Technology, Chicago, IL (USA); Alabama Gas Corp., Pinson (USA)). Apr 1986. 11p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900442.

From American Gas Association: distribution/transmission conference; Chicago, IL, USA (28 Apr 1986).

The Industrial Education Group at the Institute of Gas Technology (IGT) has developed video-based training programs for LNG plant personnel under the guidance of an industry advisory panel. The programs consist of 39 video taped lessons with accompanying text for peakshaving plant personnel and 24 video taped lessons with accompanying text for satellite plant personnel. A computer-based testing/grading/record-keeping service is also provided as an option with either program. The training programs were developed in response to requirements of the "Liquefied Natural Gas Facilities: Federal Safety Standards" issued by the Department of Transportation, Material Transportation Bureau's Research and Special Programs. That standard, promulgated under the Natural Gas Pipeline Safety Act of 1968, as amended, was issued in 1980 as a new Part 193 contained under Title 49 of the Code of Federal Regulations. Subpart H, "Qualifications and Training," specifies the training requirements for operating and maintenance personnel. 5 tabs.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 13179, 13604

13203 **(DOE/OR/00033—T265) The Natural Gas Data Redbook 1983 update.** Boercker, S.W.; Sigmon, E.B.; Reister, D. (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1985. Contract AC05-76OR00033. 150p. NTIS, PC A07/MF A01. File Number DE87004877.

This Natural Gas Data Redbook (Redbook) is designed to assist in the quality control of natural gas data. Discrepancies are identified by comparing similar data from two different data collection systems and by studying revisions of published monthly estimates. The Redbook contains five separate comparisons, as well as an analysis of monthly estimates published by the Reserves and Natural Gas Division (RNGD) of the Office of Oil and Gas. The comparisons are: (1) production, wet after lease separation (EIA 23 and EIA 627); (2) underground storage injections and withdrawals (EIA 176 and EIA 191/FPC 8); (3) electric utility consumption (EIA 176 and EIA 759); (4) deliveries to consumers (EIA 176 and FERC 50); and (5) imports (FERC 15 and FPC 14). Data on each of these quantities are gathered by the Energy Information Administration (EIA) on at least two different forms. The most immediately useful comparisons for purposes of quality control are deliveries to consumers by category from the EIA 176 and FERC 50 data systems, which are compared by state and by company. An integral part of the Redbook is the presentation and discussion of generic differences between the data systems being compared. In all cases, reporting periods, respondent frames, and/or definitions differ on the two systems. Examples of these differences are (1) the frame for the FERC 50 does not include producers and plants selling directly to consumers, but the EIA 176 frame does; and (2) definitions of the commercial, industrial, and electric utility sectors on EIA 176 are not identical with those on FERC 50.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 13180, 13181

13204 (N—87-10263, pp vp) **Gas dispersion measurements using a mobile Raman lidar system.** Houston, J.D.; Brown, D.R. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The exploitation of natural gas resources to supply energy demands has resulted in the need to engineer pipelines and plants capable of handling extremely high pressures and throughputs. Consequently, more attention has been directed to evaluating the consequences of releases of material whether accidental or deliberate in nature. An important aspect of assessing the consequences of a release is an understanding of how gas disperses in the atmosphere over a wide range of release and atmospheric conditions. The most cost effective way of providing such information is through the development and use of reliable theoretical prediction methods. The need for some form of remote sensing device was identified. The various possibilities studied led to the conclusion that LIDAR (Light Detection And Ranging) offered the most suitable method. The system designed and built is described, and its recent use in monitoring operational ventings from a high pressure transmission system is discussed.

0309 Artificial Stimulation

13205 (PB—87-102166/XAB) **Rock Creek methane from multiple coal seams completion project. Phase 1 test plan. Topical report, March 1983-December 1985.** Boyer, C.M.; Hirko, N.M. (USX Corp., Monroeville, PA. USS Technical Center). Dec 1985. 77p. (REPT—76-H-088/089-TR). NTIS, PC A05/MF A01.

The project is a six-year program that will encourage the development of coalbed gas as a viable resource, thus providing an additional natural gas resource base for the gas consumer. A series of test plans have been established to track the technical development of the project as well as to track the project costs and resources. The report details the plans utilized during Phase I to achieve the program objective.

13206 (PB—87-121034/XAB) **Development and evaluation of technology for methane production from a deep coal seam in the Piceance Basin. Annual report, June 1, 1985-May 31, 1986.** Schwoebel, J.J.; Logan, T.L.; Decker, A.D.; Cooper, J.D. (Resource Enterprises, Inc., Grand Junction, CO (USA)). Sep 1986. 93p. NTIS, PC A05/MF A01.

The Red Mountain Site, leased and operated by Resource Enterprises, Inc. is the focus of a six-year, multi-well project with a main objective to develop, improve, evaluate and communicate the technology required to produce gas from deeply buried coal. To understand the parameters controlling coalbed gas production, project efforts are focused on a single coal reservoir (the Cameo Coal 'D' Seam) at the test site. Last year, 1 Deep Seam was stimulated with a nitrogen foam fracture. Post-stimulation stabilized gas production is approximately 20 Mcfd, accompanied by water production of 1 Bpd. Extensive pre-frac testing was performed on 2 Deep Seam including step-rate tests, pump-in/flow-back tests, and a 20,000 gallon mini-frac. The well was successfully fracture stimulated with approximately 122,00 gallons of 40-lb linear gel and 260,000 lbs of 20/40 mesh sand. The well stimulation was designed to selectively place the proppant in the D coal seam. Post-stimulation gas production reached over 100 Mcfd; however, it has declined to 40 Mcfd at present. A horizontal drainhole will be attempted in 3 Deep Seam. The overall objective is to test and evaluate the effectiveness of drainhole completion technology in a coal reservoir.

13207 (PB—87-133781/XAB) **Hydrologic characterization of coal seams for methane recovery--Activity 7-1 progress report: single-phase saturated and unsaturated flow-parametric study. Topical report, January 1985-March 1986.** Way, S.C.; Bumb, A.C.; Koenig, R.A.; McKee, C.R.; Reverand, J.M. (In-Situ, Inc., Laramie, WY (USA)). Oct 1986. 96p. NTIS, PC A05/MF A01.

The report is part of a program to hydrologically characterize coal seams for methane recovery. The overall objective is to develop procedures for well testing and analysis in regions of quasi two-phase, unsaturated, and two-phase flow--regimes controlled by a large number of parameters. An approximate analytical solution to saturated and unsaturated single-phase flow when bottom-hole pressure is held constant was developed and the solution used to run two separate parametric studies to determine the sensitivity of gas desorption to various input parameters. The parameters were then ranked from most to least important in their influence on total methane released.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 13846

13208 (CONF-860992—1) **Distribution robotics in the gas industry: Issues and applications.** Sweetwood, L.A. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 17p. Institute of Gas Technology, 3424 S. State St., Chicago, IL 60616. File Number TI87900451.

From Integrating microelectronics into gas distribution symposium; Fontana, WI, USA (8 Sep 1986).

The new engineering field of "Distribution Robotics" is emerging in the gas industry. The purpose of this paper is to encourage the gas utility managers and engineers to take notice to this new technology and start factoring it into their planning strategies. The defined goal of distribution robotics is to improve the quality of service, lower operating costs, reduce work hazards, and perform in situ tasks. Applications of the distribution robotic system range from internal leak detection and repair to pipe condition assessment and cleaning; as stated, these applications are performed in a live system. To achieve the desired application missions, the robotic system requires robots of different designs along with appropriate tools, peripherals, and external support systems. The robot consists of several subsystems that allow motion, sensory perception, action and reaction, communication, and entering or existing the system. Each subsystem has several choices for robot configurations with advantages and trade-offs for the purpose, mode, range, and speed required by each mission. External support systems are required for a complete distribution robotic system. An external computer and human operator are needed as well as the physical hardware necessary to support a robot operation. Finally, issues raised by a distribution robotic system need consideration for proper planning. The major issues raised are robot miniaturization, obstacles, safety, coverage, and control.

13209 (CONF-860992—2) **Advanced gas distribution research at IGT [Institute of Gas Technology].** Rush, W.F. (Institute of Gas Technology, Chicago, IL (USA)). Sep 1986. 11p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900452.

From Integrating microelectronics into gas distribution symposium; Fontana, WI, USA (8 Sep 1986).

IGT is developing an "advanced distribution system" that addresses the automation of distribution from a total system perspective. Program objectives are to demonstrate the technical feasibility of this concept and to assist the gas industry by identifying the final state toward which automated distribution technology is evolving. Automated distribution systems have five key requirements: a sensor or encoder, a communication link, a data decoder or display unit, a power supply, and an installation technique. The total system approach facilitates exploitation of the intrinsic efficiencies and synergies among these five key features. The IGT approach to automated system design includes: (1) a total integrated system design, (2) compatibility among components, (3) modular design that accommodates the diversity of individual utility requirements, (4) distributed intelligence, and (5) provision for future technological expansion. IGT began developing a prototype of this system with a five task program. First, 14 components were defined in order to automate 28 utility operations. These definitions included component function, communication requirements, interface and operating requirements, and failure mode. Second, system issues arising from the interaction of individual components were resolved. Third, a laboratory version of the integrated system was de-

signed to test the thoroughness of the definitions. Fourth, construction of the laboratory system was initiated to test the designs, demonstrate the technical feasibility of the system, and identify and resolve a variety of practical problems. Finally, well-developed technologies are being investigated to determine the extent to which they can be integrated into the system.

13210 **(CONF-860992—3) Overview of gas automation.** Huebler, J.E. (Institute of Gas Technology, Chicago, IL (USA)). Sep 1986. 12p. Institute of Gas Technology, 3424 South State St., Chicago, IL 60616. File Number TI87900453.

From Integrating microelectronics into gas distribution symposium; Fontana, WI, USA (8 Sep 1986).

The automation of gas distribution is occurring in several areas at ever increasing rates. It is difficult to keep track of the developments and their interrelationships. This paper offers a conceptual framework within which to view and understand the rapidly developing automation of gas distribution systems. This framework relates the forces driving automation, general approaches, key trends, and features common to automation systems. It also discusses practical design considerations along with automation potential and challenge.

13211 **(CONF-8604218—2) A total system approach to automating gas distribution.** Rush, W.F. Jr.; Huebler, J.E.; Ziolkowski, C.J. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 14p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900450.

From American Gas Association: distribution/transmission conference; Chicago, IL, USA (28 Apr 1986).

IGT is supporting the development of advanced automated gas distribution systems. This work has provided insight into the forces which guide the evolution of these systems. A typical approach is to automate portions of the system that are initially viewed as separate. As a utility seeks more integrated control over its operations, it begins to build "bridges" between the "islands of automation" that have evolved. Costs and inefficiencies arise because of the incompatibility of system components that were not originally intended to operate together. In addition, utilities have begun to recognize and to exploit a number of efficiencies and synergies that exist between hardware components. These arguments suggest that future automated systems will evolve to be more fully integrated than those now being constructed. We anticipate that at the completion of the transition period to automated systems, they will be characterized by (1) a total integrated system design; (2) compatibility among components; (3) modular design that accommodates the diversity of individual utility requirements; (4) distributed intelligence; and (5) provision for future technological expansion. One purpose of the present IGT project is to assist utilities in making better decisions during the transition period. Goals include identifying the final state toward which automated system technology will evolve. Insight into the final destination should suggest optimium interim paths.

0330 Properties

REFER ALSO TO CITATION(S) 13192, 13217, 13571

13212 **(CONF-860482—1) Availability of NBS [National Bureau of Standards]-traceable calibration gas standards from IGT [Institute of Gas Technology]: Program update.** Solka, B.H.; Attari, A. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1986. 14p. Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616. File Number TI87900449.

From Symposium on natural gas energy measurement; Chicago, IL, USA (30 Apr 1986).

The Institute of Gas Technology has provided the American gas industry with natural gas standards of certified calorific value and specific gravity since 1965. In August of 1984, a research program was established at IGT to study the factors that may influence the stability of natural gas calibration standards during their preparation, storage and use. The information obtained in the course of this study is being utilized to prepare a series of calibration standards for natural gas measurements by gas chromatography and calorimetry. This paper will review the history of previous work and the cooperative research activities that lead to the preparation and availability of the new calibration standards that are traceable to the primary standards from the National Bureau of Standards (NBS). 1 fig., 6 tabs.

13213 **(PB—87-116257/XAB) Analysis of gases in the earth's crust. Annual report, March 1985-February 1986.** Jenden, P.D. (Global Geochemistry Corp., Canoga Park, CA (USA)). May 1986. 222p. NTIS, PC A10/MF A01.

In order to investigate the origin and fate of natural gas in the earth's crust, approximately 700 gas samples have been analyzed for chemical composition and stable isotopic ratios of carbon, hydrogen, nitrogen, sulfur and oxygen. During the current reporting period, helium isotope measurements confirmed the presence of mantle volatiles in the Sacramento basin, a dry gas province in northern California (Section 3.1). Methane carbon isotope ratios and N_2Ar ratios suggest that Sacramento basin commercial gases with up to 88% nitrogen are derived from metasedimentary rocks. Studies of seep gases in Los Angeles indicate that ethane and higher hydrocarbons may be retarded during natural gas migration and that propane is selectively attacked during bacterial alteration. Carbon dioxide reduction and acetate dissimilation, the two main pathways for microbial methane formation, are characterized by different methane hydrogen isotope ratios. Hydrogen isotope ratios of methane and carbon isotope ratios of carbon dioxide and ethane help to distinguish microbial gases, thermogenic gases, and mixed gases (Section 3.2).

13214 **(PB—87-141487/XAB) Natural gas handbook.** Ludtke, P.R. (National Bureau of Standards, Boulder, CO (USA). Chemical Engineering Science Div.). Aug 1986. 109p. (NBSIR—86/3057). NTIS, PC A06/MF A01.

A Natural Gas Handbook was prepared to help Air Force BCE personnel better understand the principles of metering and selling natural gas on an energy-content basis. The various aspects of natural gas such as heating value, moisture content, and hydrogen sulfide content are discussed. The characteristics of the various types of meters currently used for flow measurements are given. The correct procedures for calculating gas utility bills, including compressibility corrections, are presented. The responsibility of the gas utility to periodically check the gas meter and instrument accuracy is discussed. A list of information that should appear on the gas utility bill is given, and the various methods of selling natural gas are discussed.

0340 Combustion

REFER ALSO TO CITATION(S) 13192

13215 **Soot production in axisymmetric laminar diffusion flames at pressures from one to ten atmospheres.** Flower, W.L.; Bowman, C.T. (Sandia National Labs.). pp 56 of Proceedings of the 21st symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Laminar axisymmetric ethylene-air diffusion flames were studied at pressures from 0.1 to 1.0 MPa (1-10 standard atmospheres) in order to gain insight into the processes controlling the evolution of soot from such flames. Measurements of the attenuation of laser light across the flame diameter were used to characterize the volume of soot present in the flame. Data were acquired as a function of axial position above the burner port, allowing independent identification and examination of regions of soot formation and soot oxidation.

13216 **A high temperature shock tube study of allene pyrolysis.** Wu, C.H.; Kern, R.D. (Dept. of Chemistry, Univ. of New Orleans, New Orleans, LA 70148). pp 97 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The importance of C/sub 3/ species in the soot formation process has been reported in laser extinction experiments and in the production of relatively high molecular weight albeit stable clusters such as C/sub 60/, Buckminsterfullerene. The authors have conducted a series of experiments on the pyrolysis of allene which show that the amount of benzene formed exceeds that recorded from an equivalent amount (with respect to carbon atom concentration) of 1,3 butadiene. In contrast, equivalent amounts of acetylene produced little or no benzene.

0350 Storage

13217 **(CONF-860821—1) Heat generation in natural gas adsorption systems.** Remick, R.J.; Tiller, A.J. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 12p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900434.

From Gaseous fuels for transportation; Vancouver, Canada (7 Aug 1986).

Experiments were conducted using a high-surface-area carbon as an adsorbent for methane to determine the impact of the heat of adsorption upon the storage capacity. The rapid filling of an adsorption storage system under conditions in which the heat of adsorption is not dissipated results in only about 75% of the methane being stored at 3.44 MPa (500 psia) as can be stored by a slow fill rate with heat dissipation. These results depend upon the initial temperature of the absorbent bed and upon the characteristics of the substrate itself. 4 refs., 5 figs.

04 OIL SHALES AND TAR SANDS

13218 **(DOE/METC—86/6046) Feasibility of establishing and operating a generic oil shale test facility.** (USDOE Morgantown Energy Technology Center, WV). Dec 1986. 73p. NTIS, PC A04/MFA01. File Number DE86006591.

The December 19, 1985, Conference Report on House Joint Resolution 465, Further continuing appropriations for Fiscal Year 1986, included instruction to DOE to conduct a feasibility study for a generic oil shale test facility. The study was completed, as directed, and its findings are documented in this report. To determine the feasibility of establishing and operating such a facility, the following approach was used: examine the nature of the resource, and establish and basic functions associated with recovery of the resource; review the history of oil shale development to help put the present discussion in perspective; describe a typical oil shale process; define the relationship between each oil shale system component (mining, retorting, upgrading, environmental) and its cost. Analyze how research could reduce costs; and determine the scope of potential research for each oil shale system component.

0404 Oil Production, Recovery, And Refining

13219 **(CONF-861145—3) Gasification characteristics of eastern oil shale.** Lau, F.S.; Rue, D.M.; Punwani, D.V.; Rex, R.C. Jr. (Institute of Gas Technology, Chicago, IL (USA); Hycrude Corp., Chicago, IL (USA)). Nov 1986. Contract AC20-83LC11039. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003953.

From Eastern oil shale symposium; Lexington, KY, USA (19 Nov 1986).

The Institute of Gas Technology (IGT) is evaluating the gasification characteristics of Eastern oil shales as a part of a cooperative agreement between the US Department of Energy and HYCRUDE Corporation to expand the data base on moving-bed hydroretorting of Eastern oil shales. Gasification of shale fines will improve the overall resource utilization by producing synthesis gas or hydrogen needed for the hydroretorting of oil shale and the upgrading of shale oil. Gasification characteristics of an Indiana New Albany oil shale have been determined over temperature and pressure ranges of 1600 to 1900°F and 15 to 500 psig, respectively. Carbon conversion of over 95% was achieved within 30 minutes at gasification conditions of 1800°F and 15 psig in a hydrogen/steam gas mixture for the Indiana New Albany oil shale. This paper presents the results of the tests conducted in a laboratory-scale batch reactor to obtain reaction rate data and in a continuous mini-bench-scale unit to obtain product yield data. 2 refs., 7 figs., 4 tabs.

13220 **(CONF-861146—12) Effects of temperature and pressure on the hydroretorting yields of three eastern oil shales.** Roberts, M.J.; Punwani, D.V.; Hu, W.C.S.; Rex, R.C. Jr. (Institute of Gas Technology, Chicago, IL (USA); Hycrude Corp., Chicago, IL (USA)). Nov 1986. Contract AC20-83LC11039. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003958.

From AIChE winter annual meeting; Miami, FL, USA (2 Nov 1986).

Hydroretorting has been demonstrated as a high yield approach for processing Eastern US oil shales. HYCRUDE and IGT are conducting research under a cooperative agreement with DOE to determine the hydroretorting characteristics of Eastern oil shales. The results of hydroretorting shales from Indiana, Alabama, and Tennessee in 100-gram batch tests conducted in the Hydroretorting Assay Unit (HAU) are presented in this paper. Oil yields as high as 218% of the Fischer Assay and carbon conversions up to 90%, 79%, and 80% for Indiana, Alabama, and Tennessee shales, respectively, were achieved. 8 refs., 11 figs., 2 tabs.

13221 **(DOE/FE/60177—2245) Mathematical modeling of oil mist formation, deposition, and drainage during oil shale retorting.** Schreiber, J.D. (Western Research Inst., Laramie, WY (USA)). May 1985. Contract FC21-83FE60177. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004383.

A mathematical model of oil mist formation and deposition, and liquid oil drainage during retorting has been formulated. The model was incorporated into the one-dimensional model of oil shale retorting developed by Braun. In this report a description of the development of the model is given. Results of a simulation of a batch retort are presented and compared with results from Braun's original model. The model predicts the expected physical behavior of liquid oil in a retort: accumulation in the cooler sections of the retort by deposition of mist, downward flow by gravity after a residual saturation is reached, and evaporation of residual oil as the retort front moves through the retort. The model is applicable both to modified in situ retorts and to surface batch retorts. 15 refs., 9 figs., 1 tab.

13222 **(DOE/FE/60177—2246) Modeling of the behavior of a multicomponent shale oil during retorting.** Schreiber, J.D. (Western Research Inst., Laramie, WY (USA)). Mar 1986. Contract FC21-83FE60177. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004405.

The one-dimensional oil shale retorting model developed originally by Braun has been modified to simulate the behavior of multicomponent shale oil during retorting. The current modifications extend an earlier model that incorporated one-component oil mist formation and deposition and liquid oil drainage into Braun's model. A sample calculation shows that the model agrees at least qualitatively with experiments; the lack of detailed experimental data precludes quantitative comparisons at this time. An attempt to include liquid water accumulation and drainage phenomena has not yet succeeded. A pressure drop calculation based on Ergun's equation has also been added, thereby incorporating pressure effects into the model. 10 refs., 11 figs., 2 tabs.

13223 **(DOE/FE/60177—2251) Radio frequency retorting tests in the low void retort.** Moore, D.F.; Saxena, V.K.; Merriam, N.W.; Cha, C.Y. (Western Research Inst., Laramie, WY (USA)). Sep 1986. Contract FC21-83FE60177. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004460.

Results from three tests using radio frequency (rf) electromagnetic energy to heat oil shale are presented in this report. A block of Green River oil shale 18 x 20 x 20 inches which contained 23.5 gallons of oil per ton of oil shale was heated. The first test was conducted at 1500 watts forward power at a frequency of 450 MHz. The block was heated almost uniformly, but, as predicted by the University of Wyoming rf retorting mathematical model, 1500

watts was not sufficient power to retort the block. Temperatures of 350 to 400°F (175 to 205°C) were attained throughout the shale block. Comparisons of calculated with measured temperatures showed fairly good agreement for the first 12 hours of the test with actual temperatures lower than calculated for the remainder of the test. The shale block was examined after the test and found to be extensively fractured. The second test was conducted at 2200 watts with a frequency of 450 MHz. The block appeared to be heating at a rate which would have retorted the shale when the rf generator broke down at 36 hours into the test. The third test was conducted at 1500 watts with a frequency of 2450 MHz. The higher frequency concentrated power into a small portion of the block and retorting was observed immediately after power was turned on. The shale block was heated to 1300°F (705°C) in a small area near the monopole. An impedance matching problem, attributed to dielectric breakdown, was observed at 17 hours into the test which interrupted heating for about two hours. At 29 hours into the test the monopole melted off and the test was terminated. The series of tests met the initial test objectives, which were to gain experience with the rf equipment while heating oil shale and acquire data for use in testing the University of Wyoming rf retorting model. 8 refs., 17 figs.

13224 **(PB—87-141065/XAB) Pollution control technical manual for Unishale B and Unishale C oil-shale retorting. Final report, October 1985-October 1986.** Gala, K.H. (Denver Research Inst., CO (USA)). Dec 1986. 530p. NTIS, PC A23/MF A01.

The report describes the Unishale B and C oil shale plants, characterizes the waste streams produced in each medium, and generally discusses the commercially available controls that can be applied to the plant waste streams. Several controls are examined in more detail for each medium to illustrate typical control technology operation. Control technology cost and performance estimates are presented, together with descriptions of the discharge streams, secondary waste streams, and energy requirements. Unishale B and C are two retorting technologies developed by UNOCAL (Union Oil Company of California). The engineering design, stream compositions, and pollution control alternatives presented do not represent or reproduce exactly those proposed or employed by UNOCAL at its Parachute facility or any other such facility. The design presented here represents one of many possible configurations for an oil shale facility based on Union's technology. Unishale B or C plants of the future can be expected to be similar to that described here.

13225 **(UCID—16986-86-3) Lawrence Livermore National Laboratory oil shale project: Quarterly report, July-September 1986.** Lewis, A.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004447.

Carbonate decomposition reaction scheme and kinetics, and chemical reaction modeling are discussed in this quarterly report. The investigators have developed an improved model for carbonate decomposition and have incorporated it into their RETORT reactor and lift-pipe models. These new relations will give more accurate model predictions under a wider range of conditions than those used previously. Chemical reaction kinetics for natural materials (e.g., fossil fuels) can often be accurately described by models using a distribution of activation energies. Following this approach, the investigators generated rate data at various heating rates or constant temperatures for a typical reaction using an average activation energy (E_o) and Gaussian distribution of various widths (σ/sub E/ = 0 to 16% of E_o). Then they fit either the rate data or the integrated rate data to simpler rate expressions. Simplified rate expressions are desirable because of the intense computer requirements posed by an accurate numerical solution of the distributed activation energy equations. In general, however, a single first-order reaction does not accurately simulate a reaction with nonzero σ/sub E/. An nth-order reaction works quite well, but n must be a function of σ/sub E/ and either heating rate or temperature. Effective kinetic parameters (n, A, and E) were determined for nonisothermal conditions (heating rates of 10°C/min, 1°C/h, and 10^{-9} °C/h) and for isothermal conditions (400, 450, and 500°C).

13226 **(UCID—16986-86-3-Rev.1) Lawrence Livermore National Laboratory, Oil Shale Project: Quarterly report, July-September 1986.** Lewis, A.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). Oct 1986. Contract W-7405-ENG-48. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87005058.

This quarterly report covers: (1) carbonate decomposition reaction scheme and kinetics; and (2) chemical reaction modeling. The decomposition of dolomite and calcite in oil shale at combustor temperatures (and to a lesser extent pyrolyzer temperatures) can cause large heat losses in a retorting process. Thus it is important to know accurately the decomposition rates as functions of reactor conditions. The investigators have developed an improved model for carbonate decomposition and have incorporated it into our RETORT reactor and lift-pipe models. They believe that these new relations will give more accurate model predictions under a wider range of conditions than those used previously. Chemical reaction kinetics for natural materials (e.g., fossil fuels) can often be accurately described by models using a distribution of activation energies. Following this approach, rate data were generated at various heating rates or constant temperatures for a typical reaction using an average activation energy (E_o) and Gaussian distribution of various widths (σ/sub E/ = 0 to 16% of E_o). Then either the rate data or the integrated rate data were fit to simpler rate expressions. Simplified rate expressions are desirable because of the intense computer requirements posed by an accurate numerical solution of the distributed activation energy equations. In general, however, a single first-order reaction does not accurately simulate a reaction with nonzero σ/sub E/. An nth-order reaction works quite well, but n must be a function of σ/sub E/ and either heating rate or temperature. Effective kinetic parameters (n, A, and E) were determined for nonisothermal conditions (heating rates of 10°C/min, 1°C/h, and 10^{-9} °C/h) and for isothermal conditions (400, 450, and 500°C). 5 figs., 3 tabs.

13227 **(UCRL—95618) Ammonia evolution during oil shale pyrolysis.** Oh, M.S.; Taylor, R.W. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 15p. (CONF-870410—8). NTIS, PC A02/MF A01. File Number DE87002555.

From 193. national meeting of the American Chemical Society; Denver, CO, USA (5 Apr 1987).

Ammonia (NH_3) evolution during pyrolysis of three Green River Formation shales and one Eastern (Devonian) shale was studied. Most of the NH_3 that evolved during Fischer Assay-type pyrolysis was dissolved in retort water; the remaining NH_3 was trapped in an acid solution. Ammonia concentrations were measured with an NH_3-sensing electrode. We varied the peak pyrolysis temperature (PT) from 350 to 750°C and the heating rate from 1 to 50°C/min. The NH_3 yields increased rapidly above the oil-generating temperatures to a maximum at PT $\simeq$ 700°C and then decreased at PT = 700°C because of decomposition of NH_3. The NH_3 yield showed no dependence on the heating rate at PT < 550°C and decreased with increasing heating rate at higher peak temperatures. The maximum yield of NH_3 at PT < 500°C reflected the organic nitrogen content. We developed a kinetic model for NH_3 evolution which takes into account the NH_3 generation from organic and inorganic nitrogen sources and NH_3 decomposition. 6 refs., 7 figs., 3 tabs.

13228 **(UCRL—95762) Reactive gases evolved during pyrolysis of Devonian oil shale.** Coburn, T.T.; Crawford, R.W.; Gregg, H.R.; Oh, M.S. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 9p. (CONF-861145—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004362.

From Eastern oil shale symposium; Lexington, KY, USA (19 Nov 1986).

Computer modeling of oil shale pyrolysis is an important part of the Lawrence Livermore National Laboratory (LLNL) Oil Shale Program. Models containing detailed chemistry have been derived from an investigation of Colorado oil shale. We are currently attempting to use models to treat more completely reactions of nitrogen and sulfur compounds in the retort to better understand emissions. Batch retorting work on Devonian oil shale is proving particularly useful for this study of nitrogen/sulfur chemistry. Im-

proved analytical methods have been developed to quantitatively determine reactive volatiles at the parts-per-million level. For example, the triple quadrupole mass spectrometer (TQMS) is used in the chemical ionization (CI) mode to provide real-time analytical data on ammonia evolution as the shale is pyrolyzed. A heated transfer line and inlet ensure rapid and complete introduction of ammonia to the instrument by preventing water condensation. Ammonia and water release data suitable for calculating kinetic parameters have been obtained from a New Albany Shale sample. An MS/MS technique with the TQMS in the electron ionization (EI) mode allows hydrogen sulfide, carbonyl sulfide, and certain trace organic sulfur compounds to be monitored during oil shale pyrolysis. Sensitivity and selectivity for these compounds have been increased by applying artificial intelligence techniques to tuning of the spectrometer. Gas evolution profiles (100 to 900°C) are reported for hydrogen sulfide, water, ammonia, and trace sulfur species formed during pyrolysis of Devonian oil shale. Implications for retorting chemistry are discussed. 18 refs., 11 figs., 3 tabs.

13229 **(UCRL—95824) Results of rapid pyrolysis experiments using eastern US oil shale in the Livermore solid-recycle retort.** Cena, R.J.; Taylor, R.W. (Lawrence Livermore National Lab., CA (USA)). Nov 1986. Contract W-7405-ENG-48. 14p. (CONF-861145—2). NTIS MF A01; 2; GPO Dep. File Number DE87004361.

From Eastern oil shale symposium; Lexington, KY, USA (19 Nov 1986).

Over the past several years Lawrence Livermore National Laboratory has operated a 2-ton/day pilot-scale solid-recycle system for the study of oil shale retorting under rapid-pyrolysis conditions. Results of processing eastern US New Albany oil shale are presented and compared with results obtained previously using two western US Green River oil shales. The retort consists of a cascading mixer and plug-flow soak-tank pyrolyzer with an air lift pipe and cascading-bed combustor. In the solid-recycle system, spent shale leaving the pyrolyzer is burned in the lift and cascading-bed combustor and then returned to the retort to heat the incoming raw shale. In laboratory experiments, when raw shale is rapidly heated in a fluidized bed of sand, oil yields above those of Fischer assay are obtained. In the present experiments, hot-recycled shale is used as the heat-carrying media, resulting in oil yields comparable to those obtained from Fischer assay. The distribution and composition of solid, oil, and gas throughout the recycle system is reported for the three shales studied. The distribution of sulfur and nitrogen during processing Green River oil shale has been the focus of environmental studies at LLNL. Eastern oil shale contains 5 to 10 times more sulfur and approximately the same amount of nitrogen as western oil shale. The high sulfur content coupled with low carbonate mineral concentrations results in significant sulfur releases in the combustor-gas, compared with trace releases for western shale. Iron oxide in the recycled solid was found to effectively scrub H_2S from the pyrolysis gas for both western and eastern shales. From 0.4 to 3% of the raw shale nitrogen is released as NO/sub x/ in the combustor-gas for western shale. Releases for New Albany shale are one-tenth these levels. 8 refs., 9 figs., 7 tabs.

13230 **The identification of organic compounds in oil shale retort water by GC and GC-MS.** Stvermer, D.H.; Ireland, R.R.; Morris, C.J.; Ng, D.J. pp 383-397 of Atomic and nuclear methods in fossil energy research. Filby, R.H. New York, NY; Plenum Press (1982).

A separation scheme is presented for the analysis of oil shale retort water by gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS). The scheme is based on liquid-liquid extraction, silica chromatography, argentation chromatography and alumina chromatography. Resulting fractions can be resolved by GC and GC-MS and several hundred compounds can be identified. Even so a large fraction of retort water contaminants will require new analytical techniques to handle non-volatile and reactive compounds.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 13064, 13188, 13220, 13228, 13229

13231 **(NIPER—83) Thermodynamic properties of organic nitrogen compounds that occur in shale oil and heavy petroleum: Topical report.** Messerly, J.F.; Todd, S.S.; Finke, H.L.; Gammon, B.E. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Jan 1987. Contract FC22-83FE60149. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001213.

Condensed-phase heat capacities and enthalpies were determined at temperatures from near 10 to 400 K for N-methylpyrrole, 2,5-dimethylpyrrole, piperidine, 2-methylpiperidine, 4-methylpyridine, and N-methylcarbazole and were used to provide the Gibbs energy, enthalpy, entropy and heat capacity along the vapor saturation line at temperatures from 0 to 400 K. The corresponding ideal gas thermodynamic properties were derived with available vapor pressure and enthalpy of vaporization data. The Gibbs energy, enthalpy, and entropy of formation were derived for the ideal gas at selected temperatures with available enthalpy of combustion data. 37 refs., 9 tabs.

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 13172

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 13224

0410 Environmental Aspects

REFER ALSO TO CITATION(S) 13230

13232 **(PB—87-110516/XAB) Control of sulfur emissions from oil-shale retorting using spent-shale absorption. Final report, October 1985-February 1986.** VanZanten, K.D.; Haas, F.C. (J and A Associates, Inc., Golden, CO (USA)). Oct 1986. 133p. NTIS, PC A07/MF A01.

The report describes an investigation of the environmental advantages/disadvantages of absorbing SO_2 onto combusted retorted oil shale. The objective of the program was to obtain more information in support of prevention of significant deterioration (PSD) permitting decisions on sulfur control and to determine if the emission of other pollutants such as nitrogen oxides (NOx) and trace elements is significantly increased by the combustion process. The program consists of two phases: Phase I developed an engineering assessment and costs for application of this sulfur-absorption process to selected leading retorting processes, and Phase II was experimental work in an integrated oil-shale pilot plant to define operability, proof of principle, and trace-element emissions. Based on the pilot-plant data obtained in this study, fluid-bed operating conditions are recommended to optimize SO_2 and NOx control. In general, conditions that favor low SO_2 emissions also favor low CO and trace hydrocarbon emissions, but do not favor low NOx emissions.

13233 **(PB—87-120507/XAB) Leaching and hydraulic properties of retorted oil shale including effects from codisposal of wastewater. Final report, October 1985-February 1986.** McWhorter, D.B.; Durnford, D.S. (Colorado State Univ., Fort Collins (USA)). Oct 1986. 165p. NTIS, PC A08/MF A01.

The report discusses the development of methods and data on the leaching and hydraulic properties of solid residues from oil shale processing. A column test, the Equilibrated Soluble Mass (ESM) test, was developed as an aid to characterizing the chemical quality of the first leachate that would issue from a disposal pile of spent oil shale, simulated by moisturizing the solid to the expected field water content, followed by an equilibration period. These tests indicate an overall negative effect on leachate quality as a result of

adding process water to the solids. A variety of hydraulic properties were measured in addition to leachate quality. Developed data permit distinguishing water transported by vapor diffusion from water that moves as bulk liquid flux.

05 NUCLEAR FUELS

13234 **(INIS-BR—455) Nuclear fuel cycle. International overview. Updating of volume 1.** (Centro de Informacoes Nucleares, Rio de Janeiro (Brazil)). 1985. 171p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. File Number DE86780521.

Presented is the updating of the volume 1 of the "Nuclear fuel cycle - International overview' series which informs about the nuclear fuel cycle in the main countries that supply and/or use nuclear energy. It intends to serve the managerial staff since it gives a global view of the fuel cycle as well as its extent in each of the countries focalized. Information about Japan, Federal Republic of Germany, United Kingdom, France, and Canada are presented. At first a summary about the situation of each country is presented and then all data for each country is presented in a tree - graphic type, using an analysis and synthesis method, developed at the Nuclear Information Center, Brazil.

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 13303

0504 Feed Processing

REFER ALSO TO CITATION(S) 13304

13235 **(PB—87-101861/XAB) Recovery of vanadium, uranium, and phosphate from Idaho phosphorite ores. Rept. of investigations/1986.** Judd, J.C.; Sandberg, R.G.; Huiatt, J.L. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1986. 22p. (BM-RI—9025). NTIS, PC A02/MF A01.

Library of Congress catalog card no. 85-600353.

The Bureau of Mines investigated the recovery of vanadium, uranium, and phosphorus from low-grade phosphorite ores and concentrate by leaching with H_2SO_4. Solvent-extraction laboratory tests were conducted to selectively recover vanadium and uranium values from acid-leach solutions.

0505 Uranium Enrichment

13236 **(UCID—20877) Evaluating conditions of ethanol fire/explosion hazard in the LIS facility.** Backovsky, J. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1986. 18p. NTIS, PC A02/MF A01. File Number DE87004446.

This document considers some of the physical conditions of a potential ethanol fire/explosion in the Laser Isotope Separation facility. The cause of the potentially hazardous conditions is assumed to be a leak or a spill from the dye-laser system of from its high-pressure ethanol supply pipe. However, neither a specific scenario, nor the likelihood of such a leak or spill, are considered. Some of the conditions necessary for an ethanol fire/explosion in the laser cabinet are considered. The fuel requirements for combustion, specifically the required ethanol fuel-release and vapor-generation rates are considered. In the second part of the report, the conditions resulting from a potential ethanol combustion in the laser cabinet - i.e., the resulting explosion pressure - and the venting requirements necessary to reduce the pressured to various levels are estimated. For these estimates, the ethanol/air mixture in the cabinet is assumed to be in near-stoichiometric proportions. 9 refs., 2 figs., 8 tabs.

13237 **New technology for uranium enrichment: What can the customer expect.** Schwennesen, J.L. (Uranium Enrichment and Assessment, US Dept. of Energy). pp 114-121 of Proceedings of the fourth Pacific Basin nuclear conference. Vogt, E.W.; Ludgate, G.A. Toronto, Ontario; The Canadian Nuclear Association (1983). (CONF-830934—).

From 4. Pacific Basin nuclear conference; Vancouver, Canada (11 Sep 1983).

Because enrichment is both politically and commercially sensitive, information about the programs in other nations is limited to that which has been released by them. The French have discussed R & D programs which include gaseous diffusion process improvements, chemical exchange, two laser isotopic separation and plasma separation process concepts. In particular development of the chemical exchange process appears to have been heavily funded. However, it has not been made public whether the process is now judged sufficiently developed for production deployment and, if so, whether there are any plans for deployment. The Urenco group started from the need to integrate the technologies which the Dutch, British, and West German partners made available to it in 1971. All used the same small class of centrifuges and the group, as a matter of development policy, has to some extent maintained two lines of development. The authors have no information on the activities of the Soviet Union, but it would be surprising if it were not conducting enrichment R & D. South Africa has been working for some time on an enrichment process to serve its own needs, as has Brazil. Australia has been investigating the prospects of entering the enrichment business, although the authors understand that these efforts have now been temporarily suspended, perhaps in part due to the change in Australian Governments earlier this year. Japan has an active program apparently primarily focused upon the centrifuge process and multithousand machine pilot plant has been operational for several years.

0508 Spent Fuels Reprocessing

13238 **(CONF-870301—4) Effects of force reflection on servomanipulator task performance.** Draper, J.V.; Moore, W.E.; Herndon, J.N.; Weil, B.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003008.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

This paper reports results of a testing program that assessed the impact of force reflection on servomanipulator task performance. The testing program compared three force-reflection levels: 4 to 1 (four units of force on the slave produce one unit of force at the master controller), 1 to 1, and infinity to 1 (no force reflection). Time required to complete tasks, rate of occurrence of errors, the maximum force applied to task components, and variability in forces during completion of representative remote handling tasks were used as dependent variables. Operators exhibited lower error rates, lower peak forces, and more consistent application of forces using force reflection than they did without it. These data support the hypothesis that force reflection provides useful information for servomanipulator operators.

13239 **(CONF-870301—5) Advanced remote handling for future applications: The advanced integrated maintenance system.** Herndon, J.N.; Kring, C.T.; Rowe, J.C. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003004.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

The Consolidated Fuel Reprocessing Program at Oak Ridge National Laboratory has been developing advanced techniques for remote maintenance of future US fuel reprocessing plants. The developed technology has a wide spectrum of application for other hazardous environments. These efforts are based on the application of teleoperated, force-reflecting servomanipulators for dexterous remote handling with television viewing for large-volume hazardous applications. These developments fully address the nonrepetitive nature of remote maintenance in the unstructured environments encountered in fuel reprocessing. This paper covers the primary

emphasis in the present program; the design, fabrication, installation, and operation of a prototype remote handling system for reprocessing applications, the Advanced Integrated Maintenance System.

13240 **(CONF-870301—7) Integrated digital control and man-machine interface for complex remote handling systems.** Rowe, J.C.; Spille, R.F.; Zimmermann, S.D. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003002.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

The Advanced Integrated Maintenance System (AIMS) is part of a continuing effort within the Consolidated Fuel Reprocessing Program at Oak Ridge National Laboratory to develop and extend the capabilities of remote manipulation and maintenance technology. The AIMS is a totally integrated approach to remote handling in hazardous environments. State-of-the-art computer systems connected through a high-speed communication network provide a real-time distributed control system that supports the flexibility and expandability needed for large integrated maintenance applications. A Man-Machine Interface provides high-level human interaction through a powerful color graphics menu-controlled operator console. An auxiliary control system handles the real-time processing needs for a variety of support hardware. A pair of dedicated fiber-optic-linked master/slave computer system control the Advanced Servomanipulator master/slave arms using powerful distributed digital processing methods. The FORTH language was used as a real-time operating and development environment for the entire system, and all of these components are integrated into a control room concept that represents the latest advancements in the development of remote maintenance facilities for hazardous environments.

13241 **(CONF-870301—12) Remote maintenance for a new generation of hot cells.** Feldman, M.J.; Grant, N.R. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003006.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

For several years the Consolidated Fuel Reprocessing Program (CFRP) at Oak Ridge National Laboratory (ORNL) has been developing facility concepts, designing specialized equipment, and testing prototypical hardware for reprocessing spent fuel from fast breeder reactors. The major facility conceptual design, the Hot Experimental Facility, was based on total remote maintenance to increase plant availability and to reduce radiation exposure. This thrust included designing modular equipment to facilitate maintenance and the manipulation necessary to accomplish maintenance. Included in the design repetoire was the development effort in advanced servomanipulator systems, a remote sampling system, television viewing, and a transporter for manipulator positioning. Demonstration of these developed items is currently ongoing, and the technology is available for applications where production operations in highly radioactive environments are required.

13242 **(LA—10725-M) Tokai densitometer manual.** Sprinkle, J.K. Jr.; Hsue, S.T.; Junck, K. (Los Alamos National Lab., NM (USA)). Jan 1987. Contract W-7405-ENG-36. 82p. (ISPO—246). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004766.

In 1979, the Tokai densitometer was installed at the Tokai Reprocessing Plant in Tokai, Japan. It uses a nondestructive active technique (K-edge absorption densitometry) to assay solutions for plutonium content. The original hardware was upgraded in 1984 and 1985. This manual describes the instrument's operation after the upgrade. 2 refs.

13243 **The advancement of remote systems technology: Past perspectives and future plans.** Hamel, W.R.; Feldman, M.J. (Instrumentation and Controls Div., Consolidated Fuel Reprocessing Program, Oak Ridge National Lab., Oak Ridge, TN 37831). pp 11-24 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—).

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

In the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory, a comprehensive remote systems development program has existed for the past five years. The new remote technology under development is expected to significantly improve remote operations by extending the range of admissible remote tasks and increasing remote work efficiency. The motivation and justification for the program are discussed by surveying the 40 years of remote operating experience which exists and considering the essential features of various old and new philosophies which have been, or are being, used in remote engineering. A future direction based upon the Remotex concept is explained, and recent progress in the development of an advanced servomanipulator-based maintenance concept is summarized to show that a new generation of remote systems capability is feasible through advanced technology.

13244 **Rocky Flats Advanced Size Reduction Facility.** Mitchell, D.L.; Aguilar, P.G.; Williams, P.M. (Rockwell International/Rocky Flats Plant, P.O. Box 464, Golden, CO 80401). pp 205-210 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—).

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

An Advanced Size Reduction Facility (ASRF) at Rocky Flats is now in the construction phase. The facility will be used to section plutonium contaminated gloveboxes and miscellaneous equipment to a size which can be easily handled and disposed of in approved waste containers. Central Research System 50 Master/Slave Manipulators and Programmed and Remote (PaR) Manipulators will be utilized to remotely strip the gloveboxes and miscellaneous equipment of their removeabale components and appendages. A plasma arc torch handled by a wall mounted PaR Model 3000 manipulator will size reduce the glovebox to the desired sizes. The nominal capacity of the facility will allow processing of one glovebox (<1.8 x 2.4 m x 3.0 m in dimensions) per eight hour shift, resulting in a greater than 50% reduction of waste shipping volume.

13245 **The state-of-the-art Model M-2 Maintenance System.** Herndon, J.N.; Martin, H.L.; Satterlee, P.E. Jr.; Jelatis, D.G.; Jennrich, C.E. (Fuel Recycle Div., Oak Ridge National Lab., Oak Ridge, TN). pp 147-154 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The Model M-2 Maintenance System is part of an ongoing program within the Consolidated Fuel Reprocessing Program (CFRP) at Oak Ridge National Laboratory (ORNL) to improve remote manipulation technology for future nuclear fuel reprocessing and other remote applications. Techniques, equipment, and guidelines which can improve the efficiency of remote maintenance are being developed. The Model M-2 Maintenance System, installed in the Integrated Equipment Test (IET) Facility at ORNL, provides a complete, integrated remote maintenance system for the demonstration and development of remote maintenance techniques. The system comprises a pair of force-reflecting servomanipulator arms, television viewing, lighting, and auxiliary lifting capabilities, thereby allowing manlike maintenance operations to be executed remotely within the remote cell mockup area in the IET. The Model M-2 Maintenance System incorporates an upgraded version of the proven Central Research Laboratories' Model M servomanipulator. Included are state-of-the-art brushless dc servomotors for improved performance, remotely removable wrist assemblies, geared azimuth drive, and a distributed microprocessor-based digital control system.

13246 **Elements of an advanced integrated operator control station.** Clarke, M.M.; Kreifeldt, J.G. (Clarke Ambrose Inc., P.O. Box 23064, Knoxville, TN 37933-1064). pp 425-432 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—).

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

One of the critical determinants of performance for any remotely operated maintenance system is the compatibility achieved between elements of the man/machine interface (e.g., master manipulator controller, controls, displays) and the human operator. In the Remote Control Engineering task of the Consolidated Fuel Reprocessing Program, considerable attention has been devoted to optimizing the man/machine interface of the operator control station. This system must be considered an integral element of the overall maintenance work system which includes transporters, manipulators, remote viewing, and other parts. The control station must reflect the integration of the operator team, control/ display panels, manipulator master controllers, and remote viewing monitors. Human factors principles and experimentation have been used in the development of an advanced integrated operator control station designed for the advance servomanipulator. Key features of this next-generation design are summarized in this presentation.

13247 **Control and electronic subsystems for the advanced servomanipulator.** Martin, H.L.; Hamel, W.R.; Killough, S.M.; Spille, R.F. (Consolidated Fuel Reprocessing Program, Oak Ridge National Lab., Instrumentation and Controls Div., Oak Ridge, TN 37831). pp 417-424 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The advanced servomanipulator (ASM) represents a new generation of electrically driven force-reflecting manipulator systems designed to be remotely maintainable. This ASM is being developed to perform remote maintenance in a nuclear fuel reprocessing plant where human access is not allowed. The primary function of the manipulator control system is to maintain stable, accurate master/slave operation while providing sensitive force reflection to the operator. The control system is based upon tightly coupled distributed digital microprocessing methods. The architectural structure of the control system is outlined and is compared to the previously developed Model M-2 Control System, and justification for the advances incorporated into the ASM structure are given. The various modes of operation and diagnostics are described, and throughput requirements associated with joint servo-control and counterbalancing are discussed. The fundamental elements of the control system are reviewed, including the processor selection (Motorola MC68000) and the language (FORTH). The purpose of this document is to review the design decisions and the resulting design selections to serve as a base for future improvements. Four main areas are covered: (1) system overview, (2) hardware implementation, (3) software partitioning, and (4) remote electronics considerations. Each area will address the specifics of the equipment or the functional requirements of the control method.

13248 **An advanced remotely maintainable force-reflecting servomanipulator concept.** Kuban, D.P.; Martin, H.L. (Engineering Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 407-416 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

A remotely maintainable force-reflecting servomanipulator concept is being developed at the Oak Ridge National Laboratory as part of the Consolidated Fuel Reprocessing Program. This new manipulator addresses requirements of advanced nuclear fuel reprocessing with emphasis on force reflection, remote maintainability, reliability, radiation tolerance, and corrosion resistance. The advanced servomanipulator is uniquely subdivided into remotely replaceable modules which will permit in situ manipulator repair by spare module replacement. Manipulator modularization and increased reliability are accomplished through a force transmission system that uses gears and torque tubes. Digital control algorithms and mechanical precision are used to offset the increased backlash, friction, and inertia resulting from the gear drives. This results in the first remotely maintainable force-reflecting servomanipulator in the world.

13249 **Analysis of the options - rationale for servomanipulator maintenance in future reprocessing plants.** Herndon, J.N.; Hamel, W.R. (Fuel Recycle Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 439 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The currently available maintenance systems which can be applied, in various combinations, to large-volume in-cell maintenance operations are (1) contact, (2) overhead cranes, (3) power manipulators, (4) mechanical master/slave manipulators, and (5) servomanipulators. The requirements for reprocessing plant maintenance are reviewed, and the capabilities of remote maintenance systems are described. A basic trade-off analysis of these remote maintenance systems considering reprocessing plant requirements is given. Justification is given for selecting the overhead crane/servomanipulator-based maintenance concept as the option most desirable for future large reprocessing plant maintenance.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 13315

13250 **(CONF-8510377—Summs.) Summary of the spent nuclear fuel transportation workshop for state officials, October 22, 1985, Springfield, Illinois. Final report.** (Illinois Dept. of Nuclear Safety, Springfield (USA); USDOE Office of Civilian Radioactive Waste Management, Washington, DC). 22 Oct 1985. 27p. NTIS, PC A03/MF A01. File Number DE87000042.

From Spent nuclear fuel transportation workshop for state officials; Springfield, IL, USA (22 Oct 1985).

On October 22, 1985, thirty-two state officials representing eighteen states attended a workshop on the transportation of spent nuclear fuel hosted by the Illinois Department of Nuclear Safety and co-sponsored by the US Department of Energy. The letter of invitation is attached to this report along with the agenda for the workshop. Also attached is the attendance list. The purposes of the workshop were to explain Illinois' inspection, escort and emergency preparedness program for spent nuclear fuel to officials from other states and to discuss the needs of the future national system when DOE begins shipping spent fuel to either a repository or a monitored retrievable storage facility. Summaries of the presentations and the reports from the discussion groups are presented.

13251 **(EGG-M—26986) Dry rod consolidation technology development.** Rasmussen, T.L.; Schoonen, D.H.; Fisher, M.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 8p. (CONF-870306—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87000435.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

The Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM) is funding a Program to consolidate commercial spent fuel for testing in dry storage casks and to develop technology that will be fed into other OCRWM Programs, e.g., Prototypical Consolidation Demonstration Program. The Program is being conducted at the Idaho National Engineering Laboratory (INEL) by the Operating Contractor, EG&G Idaho, Inc. Hardware and software have been designed and fabricated for installation in a hot cell adjacent to the Test Area North (TAN) Hot Shop Facility. This equipment will be used to perform dry consolidation of commercial spent fuel from the Virginia Power (VP) Cooperative Agreement Spent Fuel Storage Cask (SPSC) Demonstration Program and assemblies that had previously been stored at the Engine Maintenance and Disassembly (EMAD) facility in Nevada. Consolidation will be accomplished by individual, horizontal rod pulling. A computerized semi-automatic control system with operator involvement will be utilized to conduct consolidation operations. Special features have been incorporated in the design to allow crud collection and measurement of rod pulling forces. During consolidation operations, data will be taken to characterize this technology. Still photo, video tape, and other docu-

mentation will be generated to make developed information available to interested parties. Cold checkout of the hardware and software will complete in September of 1986. Following installation in the hot cell, consolidation operations will begin in January 1987. Resulting consolidated fuel will be utilized in the VP Cooperative Agreement SFSC Program.

13252 **(ORNL/CSD/TM—239) HEATING6 analysis of international thermal benchmark problem sets 1 and 2.** Childs, K.W.; Bryan, C.B. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 56p. NTIS, PC A04/MF A01; GPO Dep. File Number DE87005293.

In order to assess the heat transfer computer codes used in the analysis of nuclear fuel shipping casks, the Nuclear Energy Agency Committee on Reactor Physics has defined seven problems for benchmarking thermal codes. All seven of these problems have been solved using the HEATING6 heat transfer code. This report presents the results of five of the problems. The remaining two problems were used in a previous benchmarking of thermal codes used in the United States, and their solutions have been previously published.

13253 **(PNL—5802) COBRA-SFS [Spent-Fuel Storage] thermal-hydraulic analyses of the CASTOR-1C and REA 2023 BWR storage casks containing consolidated spent fuel.** Rector, D.R.; Cuta, J.M.; Lombardo, N.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 130p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87004450.

Consolidation of spent nuclear fuel rods is being considered as one option for more efficient and compact storage of reactor spent fuel assemblies. In this concept, rods from two disassembled spent fuel assemblies will be consolidated in a space originally intended to store a single unconsolidated assembly. The thermal performance of consolidated fuel rods in dry storage, especially in multiassembly storage systems, is one of the major issues that must be addressed prior to implementation. In this study, Pacific Northwest Laboratory researchers performed thermal-hydraulic analyses for both the REA 2023 cask and the CASTOR-1C cask containing either unconsolidated or consolidated BWR spent fuel assemblies. The objective was to determine the effect of consolidating spent fuel assemblies on the temperature distributions within both types of casks. Two major conclusions resulted from this study. First, a lumping technique (combining rods and flow channels), which reduces the number of computational nodes required to model complex multiassembly geometries, could be used for both unconsolidated and consolidated rods with negligible effect on prediction accuracies. Second, with a relatively high thermal conductivity backfill gas (e.g., helium), the predicted peak fuel rod temperature in a canister of consolidated rods generating the same amount of heat as an unconsolidated assembly is essentially the same as the peak temperature in the unconsolidated assembly. In contrast, with a relatively low thermal conductivity backfill gas (e.g., nitrogen), the opposite is true and the predicted peak temperature in a consolidated canister is significantly higher than in an unconsolidated assembly. Therefore, when rods are consolidated, selection of the backfill gas is important in maintaining peak rod temperatures below allowable values for rods with relatively high decay heat generation rates.

13254 **(PNL—5946) Rod consolidation at the West Valley Demonstration Project.** Bailey, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004226.

A rod consolidation demonstration with irradiated pressurized water reactor fuel was recently conducted by personnel from Nuclear Assurance Corporation and West Valley Nuclear Services Company at the West Valley Demonstration Project in West Valley, New York. The rod consolidation demonstration involved pulling all of the fuel rods from six fuel Assemblies. In general, the rod pulling proceeded smoothly. The highest compaction ratio attained was 1:8:1. Among the total of 1074 fuel rods were some known degraded rods (they had collapsed cladding, a result of in-reactor fuel densification), but no rods were broken or dropped during the demonstration. One aim was to gather information on the effect of rod consolidation operations on the integrity of the fuel rods during subsequent handling and storage. Another goal was to collect information on the condition and handling of intact, damaged, and failed fuel that has been in storage for an extended period. 9 refs., 8 figs., 1 tab.

13255 **(PNL—6049-Vol.2) COBRA-SFS [Spent Fuel Storage]: A thermal-hydraulic analysis computer code: Volume 2, User's manual.** Rector, D.R.; Cuta, J.M.; Lombardo, N.J.; Michener, T.E.; Wheeler, C.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 346p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE87004084.

COBRA-SFS (Spent Fuel Storage) is a general thermal-hydraulic analysis computer code used to predict temperatures and velocities in a wide variety of systems. The code was refined and specialized for spent fuel storage system analyses for the US Department of Energy's Commercial Spent Fuel Management Program. The finite-volume equations governing mass, momentum, and energy conservation are written for an incompressible, single-phase fluid. The flow equations model a wide range of conditions including natural circulation. The energy equations include the effects of solid and fluid conduction, natural convection, and thermal radiation. The COBRA-SFS code is structured to perform both steady-state and transient calculations; however, the transient capability has not yet been validated. This volume contains the input instructions for COBRA-SFS and an auxiliary radiation exchange factor code, RADX-1. It is intended to aid the user in becoming familiar with the capabilities and modeling conventions of the code.

13256 **(PNL—6049-Vol.3) COBRA-SFS [Spent Fuel Storage]: A thermal-hydraulic analysis computer code: Volume 3, Validation assessments.** Lombardo, N.J.; Cuta, J.M.; Michener, T.E.; Rector, D.R.; Wheeler, C.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. 377p. NTIS, PC A17/MF A01. File Number DE87004901.

This report presents the results of the COBRA-SFS (Spent Fuel Storage) computer code validation effort. COBRA-SFS, while refined and specialized for spent fuel storage system analyses, is a lumped-volume thermal-hydraulic analysis computer code that predicts temperature and velocity distributions in a wide variety of systems. Through comparisons of code predictions with spent fuel storage system test data, the code's mathematical, physical, and mechanistic models are assessed, and empirical relations defined. The six test cases used to validate the code and code models include single-assembly and multiassembly storage systems under a variety of fill media and system orientations and include unconsolidated and consolidated spent fuel. In its entirety, the test matrix investigates the contributions of convection, conduction, and radiation heat transfer in spent fuel storage systems. To demonstrate the code's performance for a wide variety of storage systems and conditions, comparisons of code predictions with data are made for 14 runs from the experimental data base. The cases selected exercise the important code models and code logic pathways and are representative of the types of simulations required for spent fuel storage system design and licensing safety analyses. For each test, a test description, a summary of the COBRA-SFS computational model, assumptions, and correlations employed are presented. For the cases selected, axial and radial temperature profile comparisons of code predictions with test data are provided, and conclusions drawn concerning the code models and the ability to predict the data and data trends. Comparisons of code predictions with test data demonstrate the ability of COBRA-SFS to successfully predict temperature distributions in unconsolidated or consolidated single and multiassembly spent fuel storage systems.

0520 Waste Management

REFER ALSO TO CITATION(S) 13141, 13142, 13306, 13310, 13317, 13491, 13518, 13816, 13819, 13830, 13835, 13851, 14483, 14485, 14492

13257 **(AECL—8382) Confidence bounds on an empirical cumulative distribution function.** Andres, T.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Nov 1986. 42p. Atomic Energy of Canada Ltd., Whiteshell Nuclear Research Establishment, Pinawa, Manitoba R0E 1L0. File Number TI87900460.

Work performed under Canada/US Waste Management Information Exchange Agreement.

Methods are developed for using data from an empirical cumulative distribution function (CDF) to generate, at each point in the range of the data, an upper confidence bound on the estimated value of the underlying CDF. The empirical CDF represents the distribution of values in a randomly selected data sample. The underlying CDF is the limiting case of the empirical CDF as the sample size approaches infinity. The two CDFs differ because of the variability inherent in a finite random sample. Formulas and graphs presented in the report can be used to calculate an upper bound on the unknown underlying CDF for confidence levels between 0 and 1. Applications are demonstrated where a confidence bound is applied to the empirical distribution of maximum effective annual dose equivalent obtained from a set of Monte Carlo simulations in an environmental assessment of nuclear fuel waste disposal. This bound can then be used to compare the empirical dose CDF with possible regulatory guidelines for dose from a disposal facility. Methods presented in the report can be used to select the number of simulations needed to meet such guidelines.

13258 **(AECL—9068) An evaluation of potential additives to a clay-based buffer material for the immobilization of I-129.** Oscarson, D.W.; Miller, H.G.; Watson, R.L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1986. 24p. (In English). Atomic Energy of Canada Limited, Chalk River, Ontario, Canada K0J 1J0. File Number TI87900461.

Work performed under Canada/US Waste Management Information Exchange Agreement.

In the long-term disposal of nuclear fuel waste, I-129 is potentially the greatest hazard to man and the environment. One possible way to slow the migration of I-129 from the nuclear fuel waste containers in a disposal vault to the biosphere is to add a material to the buffer (a buffer material composed of bentonite and sand will be used to surround the waste containers) that will immobilize I-129. This paper examines the potential effectiveness of Cu, Bi, Fe, and hydrotalcite-like (HT) minerals in immobilizing I-129 via either a solubility control or a sorption mechanism under conditions expected in a disposal vault in the Canadian Shield. The results indicate that none of the minerals examined would be effective buffer additives: solid Cu- and Bi-I phases have limited stability fields under conditions expected in a disposal vault; Fe minerals (magnetite and Fe-silicate) have little or no sorption affinity for I-; and although T minerals sorb I- under some conditions, they have relatively low selectivity coefficients for I-. It is concluded from this and other studies that additives to a buffer material in a disposal vault would not be an effective means of immobilizing I-129.

13259 **(ANL/EES-TM—316) Radioactive waste isolation in salt: Peer review of the Office of Nuclear Waste Isolation's draft report on an issues hierarchy and data needs for site characterization.** Harrison, W.; Fenster, D.F.; Ditmars, J.D.; Paddock, R.A.; Rote, D.M.; Hambley, D.F.; Seitz, M.G.; Hull, A.B. (Argonne National Lab., IL (USA)). Dec 1986. Contract W-31-109-ENG-38. 133p. NTIS, PC E08/MF $5.70; 1; GPO Dep. File Number DE87004445.

At the request of the Salt Repository Project (SRPO), Argonne National Laboratory conducted an independent peer review of a report by the Battelle Office of Nuclear Waste Isolation entitled "Salt Repository Project Issues Hierarchy and Data Needs for Site Characterization (Draft)." This report provided a logical structure for evaluating the outstanding questions (issues) related to selection and licensing of a site as a high-level waste repository. It also provided a first estimate of the information and data necessary to answer or resolve those questions. As such, this report is the first step in developing a strategy for site characterization. Microfiche copies of "Draft Issues Hierarchy, Resolution Strategy, and Information Needs for Site Characterization and Environmental/Socioeconomic Evaluation - July, 1986" and "Issues Hierarchy and Data Needs for Site Characterization - February, 1985" are included in the back pocket of this report.

13260 **(BMI/ONWI—627) Influence of variables on the consolidation and unconfined compressive strength of crushed salt: Technical report.** Pfeifle, T.W.; Senseny, P.E.; Mellegard, K.D. (RE/SPEC, Inc., Rapid City, SD (USA); Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jan 1987. Contract AC02-83CH10140. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87005209.

Eight hydrostatic compression creep tests were performed on crushed salt specimens fabricated from Avery Island dome salt. Following the creep test, each specimen was tested in unconfined compression. The experiments were performed to assess the influence of the following four variables on the consolidation and unconfined strength of crushed salt: grain size distribution, temperature, time, and moisture content. The experiment design comprised a half-fraction factorial matrix at two levels. The levels of each variable investigated were grain size distribution, uniform-graded and well-graded (coefficient of uniformity of 1 and 8); temperature 25°C and 100°C; time, 3.5 x 10^3s and 950 x 10^3s (approximately 60 minutes and 11 days, respectively); and moisture content, dry and wet (85% relative humidity for 24 hours). The hydrostatic creep stress was 10 MPa. The unconfined compression tests were performed at an axial strain rate of 1 x $10^{-5}s^{-1}$. Results show that the variables time and moisture content have the greatest influence on creep consolidation, while grain size distribution and, to a somewhat lesser degree, temperature have the greatest influence on total consolidation. Time and moisture content and the confounded two-factor interactions between either grain size distribution and time or temperature and moisture content have the greatest influence on unconfined strength. 7 refs., 7 figs., 11 tabs.

13261 **(CONF-870211—2) Methodology for oversizing marginal quality riprap for erosion control at uranium mill tailings sites.** Staub, W.P.; Abt, S.R. (Oak Ridge National Lab., TN (USA); Colorado State Univ., Fort Collins (USA)). 1987. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004060.

From 9. annual symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (2 Feb 1987).

Properly selected and oversized local sources of riprap may provide superior erosion protection compared with revegetation at a number of uranium mill tailings sites in arid regions of the United States. Whereas highly durable rock is appropriate for protecting diversion channels to the height of the 5-year flood, marginal quality rock may be adequate for protecting infrequently flooded side slopes of diversion channels, tailings embankments and caps. Marginal quality rock may require oversizing to guarantee that design size specifications are met at the end of the performance period (200 to 1000 years). This paper discusses a methodology for oversizing marginal quality rock. Results of cyclic freezing and thawing tests are used to determine oversizing requirements as functions of the performance period and environment. Test results show that marginal quality rock may be used in frequently saturated areas but in some cases oversizing will be substantial and in other cases marginal quality rock may be disqualified. Oversizing of marginal quality rock appears to be a practical reality in occasionally saturated areas (between the 5-year and 100-year floods). Furthermore, oversizing will not generally be required on slopes from the 100-year flood. 6 refs., 4 tabs.

13262 **(DOE/CH/10280—1) Draft area recommendation report for the Crystalline Repository Project, January 1986.** (Great Lakes Indian Fish and Wildlife Commission, Odanah, WI (USA)). 15 Apr 1986. Contract FG02-86CH10280. 130p. NTIS, PC A07/MF A01; GPO Dep. File Number DE87003216.

This comment on the Draft Area Recommendation Report (DARR) for the Crystalline Repository Project discusses the reasons the DARR is fundamentally flawed, among them the exclusion of Indian tribes from the development of the standards by which the DARR is to be judged, the exclusion from the standards of topics of importance to tribes, the inadequacy of the standards to the region-to-area screening process, and the inconsistency of the standards with the Nuclear Waste Policy Act (NWPA) and the federal trust responsibility. (ACR)

13263 **(DP-MS—86-51) Corrosion in the off-gas system of a radioactive-waste incinerator.** Jenkins, C.F.; Peters, J.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 29p. (CONF-870314—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002646.

From Corrosion '87; San Francisco, CA, USA (9 Mar 1987).

Corrosion in a low-level radioactive-waste incinerator off-gas system at the Department of Energy's Savannah River Plant is discussed. Severe corrosive attack and failure of an alloy 600 part exposed to high-temperature (>1000°C) gases was observed. Rapid attack of carbon steel components, and cracking of austenitic stainless steel parts also occurred at locations where lower gas temperatures and periodic condensate exposure occurred. Investigation showed HCl, SO_2, SO_3 and phosphorus-oxides were present and contributed to the failures. Mechanisms of high-temperature failure include alloy separation and reactions with phosphorus. Coupons placed in the exhaust stream have provided information for selection of future materials of construction for system components. Several nickel- and iron-base alloys, and a stainless steel with an aluminum-diffusion coating were investigated.

13264 **(DP-MS—86-178) Electrochemical probing of high-level radioactive waste tanks containing washed sludge and precipitates.** Bickford, D.F.; Congdon, J.W.; Oblath, S.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1986. Contract AC09-76SR00001. 28p. (CONF-870314—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002653.

From Corrosion '87; San Francisco, CA, USA (9 Mar 1987).

At the US Department of Energy's Savannah River Plant, corrosion of carbon steel storage tanks containing alkaline, high-level radioactive waste is controlled by specification of limits on waste composition and temperature. Processes for the preparation of waste for final disposal will result in waste with low corrosion inhibitor concentrations and, in some cases, high aromatic organic concentrations, neither of which are characteristic of previous operations. Laboratory tests, conducted to determine minimum corrosion inhibitor levels indicated pitting of carbon steel near the waterline for proposed storage conditions. In situ electrochemical measurements of full-scale radioactive process demonstrations have been conducted to assess the validity of laboratory tests. Probes included pH, Eh (potential relative to a standard hydrogen electrode), tank potential, and alloy coupons. In situ results are compared to those of the laboratory tests, with particular regard given to simulated solution composition. Transition metal hydroxide sludge contains strong passivating species for carbon steel. Washed precipitate contains organic species that lower solution pH and tend to reduce passivating films, requiring higher inhibitor concentrations than the 0.01 molar nitrite required for reactor fuel reprocessing wastes. Periodic agitation, to keep the organic phase suspended, or cathodic protection are possible alternatives to higher nitrite inhibitor concentrations.

13265 **(DPST—85-793) SRP decontamination and decommissioning scoping study.** Martin, W.P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1986. Contract AC09-76SR00001. 68p. NTIS, PC A04. File Number DE87004512.

Of the approximately 3000 site facilities, 496 were judged to be radioactively contaminated thereby requiring Decontamination and Decommissioning (D & D) after shutdown. To enable projection of D & D timing for each of the 496 facilities, a plant shutdown schedule was developed. A 5-year "cool-down" period was added to the highly contaminated facilities to allow radioactive decay resulting in a reduction of cost, waste volume, and radiation exposure. D & D of all facilities is projected to be completed in FY 2045. Since essentially all of the plant facilities are scheduled to operate past FY 2000, only seventy-four of the 496 facilities are projected to be decommissioned prior to FY 2000. These facilities include currently excessed facilities and those scheduled for shutdown in the near future - seepage basins, HWCTR, R-Reactor, high level waste tanks, etc. The type of D & D chosen is the factor having the most significant effect on D & D costs and waste volumes. The two types of final D & D are Entombment and Dismantlement. Dismantlement can increase costs and waste volumes by a factor of 2 to 100 compared to Entombment. This point should be kept in mind when reviewing this scoping study as approximately 75% of the projects are estimated based upon the less costly Entombment option. The D & D estimates for the 496 facilities are summarized by plant area in Table 3 and by custodian group (Program/General Department) in Table 4. The total estimated D & D cost in constant FY 1986 dollars is approximately $800,000,000, with total solid waste volumes of 5,000,000 and 170,000 cubic feet, for low level waste (LLW) and transuranic waste (TRU), respectively. A 6% annual escalation factor increases the total project costs of 800,000,000, FY 1986 dollars to 7 billion dollars. 27 refs.

13266 **(EGG—2483) Buried Transuranic Waste Studies Program at the Idaho National Engineering Laboratory: Annual technology assessment and progress report.** Low, J.O.; Allman, D.W.; Shaw, P.G.; Sill, C.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1987. Contract AC07-76ID01570. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87004564.

In-situ grouting, an improved-confinement technology that could be applied to the Idaho National Engineering Laboratory (INEL) shallow-land-buried transuranic (TRU) waste, is being investigated by EG & G Idaho, Inc. In situ grouting has been demonstrated as the culmination of a two-year engineering feasibility test at the INEL. In situ stabilization and hydrologic isolation of a simulated buried TRU waste trench at an arid site were performed using an experimental dynamic compaction in situ grouting process developed by Rockwell Hanford Operations (RHO). A series of laboratory evaluations relative to the grout permeation characteristics of microfine particulate cements with INEL-type soil was performed prior to the grouting operations. In addition, an extensive pre-grouting hydrologic assessment of the test trench was performed to support the performance assessment analysis. Laboratory testing of various chemical materials yielded a suitable hydrologic tracer for use in the hydrologic monitoring phase of the experiment. Various plutonium transport laboratory evaluations were performed to assess the plutonium retention capabilities of a microfine grout/INEL-soil waste product similar to that expected to result if the grout is injected in situ into the INEL test trench. The test trench will be hydrologically assessed in FY 1987 to determine if the RHO grouting system attained the performance acceptance criteria of the experiment. The report includes a technology assessment of buried waste technologies developed by other DOE sites. Field demonstrations at ORNL and Hanford are reported under this technology assessment. Also included is information on activities related to buried waste management at the INEL. These include environmental surveillance of the Radioactive Waste Management Complex and the Subsurface Migration Studies Program.

13267 **(EIR—563) Geochemistry of the near-field.** McKinley, I.G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Oct 1985. 94p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86780503.

This report describes a study of the Swiss disposal concept used in 'Project Gewaehr 1985' safety analysis. The main components of the near-field of a high level waste repository are the waste glass matrix, the thick steel canister and the surrounding backfill of compressed bentonite. In this report it is concluded that mineralogical alteration of the backfill will be negligibly small over the million year period considered. Its physical and chemical properties can thus be relied on for such a period. The canister will retain its integrity for $> 10^3$ y and thereafter will act as an Eh/pH buffer. The near-field buffers ensure more alkaline and reducing conditions than in the far-field. Complete degradation of the glass matrix will take $> 10^5$ years and nuclide release will be limited by their congruent dissolution although it may be further constrained

by low solubility. Diffusion of dissolved nuclides through the backfill is so slow that many species decay to insignificance within it. The large uptake capacity of the bentonite also significantly extends the release duration for longer lived, non-solubility limited nuclides thus decreasing output mixima. Possible perturbing factors such as radiolysis and hydrogen production by anoxic corrosion are of little importance but modeling of speciation/solubility in the near-field and, in particular, colloid formation and mobility are identified as areas in which more work is required. Although the main analysis aims to err on the side of conservatism, the extent of such pessimism is assessed in a 'realistic' appraisal of the near-field. This suggests that the engineered barriers will prevent any radiologically significant releases over periods in excess of a million years which would strengthen their role in the multiple barrier safety concept.

13268 (INIS-mf—10092) **Royal Decree 1899/1984 of 1 August amending Royal Decree 2967/1979 of 7 December on the organization of activities in the nuclear fuel cycle.** (International Atomic Energy Agency, Vienna (Austria)). 27 Oct 1984. 2p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780525.

Under the Decree of 1979 the "Empresa Nacional del Uranio SA" (National Uranium Enterprise - ENUSA) was responsible for spent management while the Junta de Energia Nuclear (JEN) was responsible for the final storage of radioactive waste. However, these provisions do not cover waste resulting from activities outside the fuel cycle or the dismantling of nuclear and radioactive installations, nor do they provide a global solution to the different problems involved in organizing the overall management of radioactive waste. Therefore, this Decree authorizes the National Enterprise for Radioactive Waste (ENRESA) to perform the tasks prescribed in this field by the 1964 Nuclear Energy Act and the 1979 Decree (NEA).

13269 (INIS-mf—10102) **Management of radioactive waste arising from the medical, industrial, and research use of radionuclides.** (International Atomic Energy Agency, Vienna (Austria)). Jan 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780533.

The management of radioactive wastes in Australia is reviewed. Technical criteria for regulated user-disposal, shallow ground disposal and long-term storage are examined. Options for ensuring adequate regional and national access to waste repositories are discussed. The Committee recommends that the code of practice for user-disposal be finalized, a national program be initiated to identify sites suitable for shallow ground burial and the Commonwealth proceed to investigate the development of facilities for interim and long-term storage.

13270 (INIS-mf—10117) **Management of high-level radioactive waste. A survey of demonstration activities.** (Nuclear Energy Agency, 75 - Paris (France)). Apr 1985. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780539.

The following aspects can be only indirectly demonstrated since they involve long periods of time. They have reached the degree of demonstrations described below. Prediction of the physical stability of mined cavities at ambient temperatures is well understood from mining experience in salt and hard rocks such as granite. For soft rocks, the stability will depend upon the characteristics of the backfill and structural materials which can be included in predictive models. Normal and abnormal mechanisms for migration of radionuclides from repositories have been generally identified. Which of these mechanisms are relevant for the future evolution of a repository system depends on the repository site. Techniques for closure and sealing of repositories have been demonstrated, but validation of their long-term performance is lacking. The ability to construct mathematical models that predict repository and environmental impacts is demonstrated. Some of these models are very sophisticated, but confidence is growing in their predictions. The reliability of results has been demonstrated, in some cases, by intercomparison of different modeling techniques; however, in many instances the models need validation. Generic data in support of models may, in many respects, be adequate. More data, and therefore R and D efforts concentrating on specific sites, are required to assist in the validation of some aspects of model predictions against the real world. This is an aspect of demonstration that continues to be necessary and is being pursued.

13271 (NUREG/CP—0079, pp 5-14) **Approaches to model groundwater flow and radionuclide transport at a German salt dome.** Buetow, E.; Heredia, L.; Luetkemeier-Hosseinipour, S.; Struck, S. (Technische Universitaet Berlin, West Germany). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

This paper discusses the approach and assumptions used to model radionuclide migration at a proposed nuclear waste facility in Germany. It discusses the procedures of calculations for input and results. The results generate a regional and a local flow model for predicting environmental impacts.

13272 (NUREG/CP—0079, pp 17-23) **Methodology developed at the CEA/IPSN for long-term performance assessment of nuclear waste repositories in geological formations.** Raimbault, P.; Lewi, J. (Institut de Protection et de Surete Nucleaire (CEA/IPSN), Fontenay aux Roses, France). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The Department of Safety Analysis (DAS) develops a global performance assessment code named MELODIE which structure allows to couple the individual models. This code participates to international joint studies such as PAGIS, in order to test its ability to model specific sites. This should help to control the adequation of the individual models to the risk assessment evaluation in order to insure the availability of specific data and to identify the most sensitive parameters. This approach should allow to coordinate the action between experimentation, code development and safety rules determination in order to be ready to perform safety assessment on chosen sites. The current status of the different aspects of this work is presented. The model development concerns mainly: transport, hydrogeology, source term, dose calculation and sensitivity studies. Its connection with data collection and model validation is stressed in the field of source modeling, hydrology, geochemistry and geoprospective. The description of the first version of MELODIE is presented. Some results of the interactive evaluation of the source term, the groundwater flow and the transport of radionuclides in a granite site are presented as well. The future developments of MELODIE will consist in including thermomechanical effects, improved geochemistry and impact models for scenarios.

13273 (NUREG/CP—0079, pp 27-40) **Development of performance assessment methodology for nuclear waste isolation in geologic media.** Bonano, E.J.; Chu, M.S.Y.; Cranwell, R.M.; Davis, P.A. (Sandia National Labs., Albuquerque, NM). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—). Contract AC04-76DP00789.

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The analysis of the processes involved in the burial of nuclear wastes can be performed only with reliable mathematical models and computer codes as opposed to conducting experiments because the time scales associated are on the order of tens of thousands of years. These analyses are concerned primarily with the migration of radioactive contaminants from the repository to the environment accessible to humans. Modeling of this phenomenon depends on a large number of other phenomena taking place in the geologic porous and/or fractured medium. These are ground-water flow, physicochemical interactions of the contaminants with the rock, heat transfer, and mass transport. Once the radionuclides have reached the accessible environment, the pathways to humans and health effects are estimated. A performance assessment methodology for a potential high-level waste repository emplaced in a basalt

formation has been developed for the US Nuclear Regulatory Commission.

13274 (NUREG/CP—0079, pp 43-52) **Performance assessment: a peer review.** Lieberman, J.A.; Lee, W.W.L. (OTHA, Inc., Glen Echo, MD). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

This paper describes the rationale, membership, operation and major observations of the Performance Assessment National Review Group. The Group was assembled by Weston at the request of the US Department of Energy Office of Civilian Radioactive Waste Management to review performance assessment work in the US basalt, salt and tuff repository projects. The purposes were to evaluate the adequacy of the current methods, identify deficiencies, and suggest potential improvement on repository performance assessment. To perform the review, Weston retained a group of distinguished consultants who have had extensive experience in disciplines pertinent to management of radioactive wastes including mathematical modeling of fluid transport. Topics reviewed included flow and transport, source term and uncertainty analysis. While the emphasis was on methodologies, the Projects were specifically requested to show currently available results so that the way they utilized familiar methodologies could be evaluated. This paper will highlight some of the technical observations of the Group as well as some managerial and institutional issues.

13275 (NUREG/CP—0079, pp 55-78) **CHAMP - a computer code for modeling transient fluid flow and chemical transport with hydrodynamic dispersion in variably saturated systems.** Narasimhan, T.; Alavi, M.; Lij, C.W. (Lawrence Berkeley Lab., CA). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

This article presents the various aspects of a computer code used to model chemical transport of pollutants in the ground water system. Little test is presented, with only graphs, charts, and equations used to present the uses of the program.

13276 (NUREG/CP—0079, pp 81-97) **SYVAC approach for long-term environmental assessments.** Goodwin, B.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The Canadian nuclear fuel waste management program is currently in the concept assessment phase, and the concept receiving most attention is one involving waste immobilization followed by isolation in plutonic rock. As assessment of this concept requires the assimilation of a wide range of field and laboratory results. Major difficulties are associated with the uncertainty in the available data, arising from the wide variability in natural systems, the need to extrapolate results far into the future, and the need to conduct a generic assessment. The computer code SYVAC has been developed to help conduct the required long-term environmental assessment. SYVAC provides a framework for incorporating results from field and laboratory research, and a method for dealing with uncertainty in the data. Examples are described that show how detailed research information is condensed for use in SYVAC. Results are presented from a recent assessment study of the Canadian concept for nuclear waste disposal.

13277 (NUREG/CP—0079, pp 101-113) **Improved site characterization using multiple approaches.** Rasmussen, T.C. (Univ. of Arizona, Tucson). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Conceptual hydrologic models are currently being formulated for the purpose of evaluating the suitability of various sites as repositories of high-level wastes. As part of the site characterization process, hydrogeologic data obtained using different acquisition methods are presented for the purpose of validating proposed theories. Preliminary documents indicate that substantial uncertainties exist with regard to the proposed theories. It is proposed that multiple conceptual models be systematically formulated using less likely, yet possible interpretations. By focusing on a suite of models, all relevant information can be used to statistically characterize the hydrologic regime. Inconsistent data may be overlooked or ignored when the conceptual model is narrowly defined. The postulated model may then result in erroneous conclusions. One measure for evaluating model reliability is to examine parameter estimates. Stable parameter estimates obtained from multiple acquisition techniques leads to greater confidence in the proposed model. In addition, if the major axis of parameter sensitivities obtained from the acquisition techniques are not acute to each other, then substantial reductions in parameter, and, hence, model uncertainties may be obtained.

13278 (NUREG/CP—0079, pp 119-127) **Groundwater flow modelling in Canada's nuclear fuel waste management program.** Guvanasen, V.; Scheier, N.W.; Chan, T. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The Canadian Nuclear Fuel Waste Management Program is investigating the concept of disposing of nuclear fuel waste in a repository in plutonic rock. An extensive program of hydrogeological field studies and computer modelling is being undertaken in this program. A three-dimensional, finite-element code, called MOTIF, has been developed to simulate the coupled processes of fluid flow and heat transport on a regional scale. Significant hydrogeological features such as major fracture zones may be modelled as planes imbedded in a porous matrix. The code has been verified by comparison with analytical solutions or published numerical solutions. A three-dimensional particle-tracking code is being developed to calculate radionuclide pathways based on groundwater velocity distributions predicted using MOTIF. Detailed hydrogeological models will be constructed for three major research areas within the Canadian Shield. The computer codes will then be used to estimate the characteristics of potential radionuclide pathways from a hypothetical repository at each site. This information will subsequently be used in the environmental and safety assessment of the concept.

13279 (NUREG/CP—0079, pp 233-256) **Hybrid approach to uncertainty in far-field groundwater flow.** Devary, J.L.; Gupta, S.K.; Harper, W.V.; Cole, C.R.; Thompson, F.L. (Battelle Project Management Division, Richland, WA). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The quantification of far-field groundwater flow uncertainty is a critical issue regarding site selection for a geologic high-level nuclear waste repository. A nonlinear relationship between geohydrologic parameters (e.g., hydraulic conductivity, potentiometric head, effective porosity) and repository performance measures (e.g., groundwater travel paths or travel times) induces an extremely complex input/output variable response. A hybrid approach involving geostatistics (kriging), adjoint sensitivity, parameter-identification, first-order variance, and Monte Carlo simulation is proposed to determine groundwater flow system uncertainty. The techniques are currently being applied to help select new borehole locations for the site characterization phase of the salt formation investigations by the Salt Repository Project of Nuclear Waste. Preliminary

results are presented from two-dimensional simulations of the Wolfcamp Formation within the Permian system.

13280 (NUREG/CP—0079, pp 283-302) **Sensitivity of calculated hydrological flows through multilayered hard rock to computational solution procedures.** Bixler, N.E.; Eaton, R.R. (Sandia National Lab., Albuquerque, NM). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Permeability and moisture content curves for partially saturated, fractured, welded tuffs, such as those found near the site of a prospective nuclear waste repository at Yucca Mountain, Nevada, are highly nonlinear. The authors illustrate, by means of a one-dimensional problem of infiltration into multilayered fractured tuff, the numerical instabilities that can arise when analyzing the flow in such porous materials. The authors compare the results obtained using two numerical schemes for treating the nonlinearities: the first uses a first-order Piccard iteration scheme to attain convergence at each time step; the second uses a second-order Newton-Raphson iteration procedure to attain convergence. The Piccard scheme converges when flow through the rock matrix dominates but does not converge when flow through fractures dominates. On the other hand, the Newton-Raphson scheme converges in both situations.

13281 (NUREG/CP—0079, pp 303-322) **Use of the PHREEQE code in modelling environmental geochemical problems encountered in performance assessment modelling.** Muller, A.B.; Parkhurst, D.L.; Tasker, P.W. (OECD Nuclear Energy Agency, Paris, France). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

It has been frequently shown that models of radionuclide transport based on empirical constant distribution coefficients (Kds) are inadequate to model the behavior of a number of radioelements (particularly those having multiple oxidation states) in many complex and heterogeneous natural rock water systems. The principal impediments to using more phenomenological models have been: (1) the lack of models accounting for all the major geochemical mechanisms involved in retardation, and (2) the lack of suitable data bases for these models. This paper shows how the PHREEQE code, an aqueous geochemical model with reaction path tracking capabilities, can be used to address problems encountered in performance assessment modelling. Examples are given for calculations involving (1) solubility and speciation of uranium, (2) the ion exchange of strontium, (3) the formation of radium solid solutions and (4) the isotopic exchange of radiocarbon with aquifer materials. There remain serious data needs, in part addressed by the NEA thermochemical data base project, and the need remains for a detailed sensitivity study on the dominant reactions to include in each modelling effort.

13282 (NUREG/CP—0079, pp 323-344) **Preliminary assessment of radionuclide vapor phase transport in unsaturated tuff.** Smith, D.M.; Updegraff, C.D.; Bonano, E.J. (Univ. of New Mexico, Albuquerque). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—). Contract AC04-76DP00789.

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The possibility of radionuclide migration in the vapor phase for unsaturated tuff has been investigated. Radionuclide movement could be the result of either aerosol migration or convection/diffusion of volatile species. A diffusion model for supersaturation of air in tuff groundwater indicates that there is no possibility of aerosol formation under expected repository conditions. An assessment of migration due to convection/diffusion requires solution of the coupled heat transfer-vapor flow-liquid flow problem around a waste canister. The TOUGH code has been used to calculate spatial and temporal distributions of liquid and vapor velocity, saturation and temperature for typical tuff formation properties. These distributions have been used to calculate the relative transport rates due to convection in the vapor phase as compared to the liquid phase. An analogous mobility ratio when diffusion dominates radionuclide transport has also been calculated. As a first order approximation, the maximum ratio of transport in the vapor phase to that in the liquid phase (irregardless of transport mechanism) is given by 1000K/sub w/ where K/sub w/ is the vapor-liquid distribution coefficient for the particular radionuclide.

13283 (NUREG/CP—0079, pp 345-365) **Application of adjoint sensitivity theory to performance assessment of hydrogeologic concerns.** Metcalfe, D.E.; Harper, W.V. (INTERA Technologies, Inc., Houston, TX). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Sensitivity and uncertainty analyses are important components of performance assessment activities for potential high-level radioactive waste repositories. The application of the adjoint sensitivity technique is demonstrated for the Leadville Limestone in the Paradox Basin, Utah. The adjoint technique is used sequentially to first assist in the calibration of the regional conceptual groundwater flow model to measured potentiometric data. Second, it is used to evaluate the sensitivities of the calculated pressures used to define local scale boundary conditions to regional parameters and boundary conditions.

13284 (NUREG/CP—0079, pp 369-380) **Discretization problems in the simulation of radio-nuclide transfer in geologic media.** Goblet, P. (Ecole Des Mines, Paris, France). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The modelling of flow and mass transport in geologic material in relationship with nuclear waste disposal problems makes use of numerical techniques which must be analyzed beforehand from the viewpoint of accuracy and performance. An important work of assessment of this kind was performed during the INTRACOIN exercise and is currently done in HYDROCOIN. Nevertheless the authors find that an even more severe testing of the numerical codes is done when trying to model an actual situation. In this short contribution they want to point out some of the practical problems encountered while working on real field data, some of the solutions envisioned and some of the yet unsolved problems. All of these problems have to do with time or space discretization in very heterogeneous media or for phenomena with highly different kinetics. The presentation will be mostly related to Finite Element techniques, as they constitute their personal experience, believing that the problems posed are relevant for most approaches.

13285 (NUREG/CP—0079, pp 383-407) **Some current problems in groundwater flow and radionuclide transport modelling.** Herbert, A.W.; Hodgkinson, D.P.; Jackson, C.P.; Lever, D.A.; Rae, J.; Robinson, P.C.; Sharland, S.M.; Tasker, P.W. (Atomic Energy Research Establishment, Harwell, England). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Reliable safety assessments of radioactive waste disposal require models of groundwater flow and radionuclide transport which are based on realistic descriptions of the most important physical and chemical migration processes. These should be calibrated and validated using laboratory and field data, evaluated using adequately verified numerical algorithms and applied so as to take appropriate account of various uncertainties. This paper outlines six problem areas where the above ideals are into currently met, and suggests some possible ways of improving this situation. The topics considered area: flow and transport in fractured media; numerical algorithms for advectively dominated transport; flow and

transport in the undersaturated zone; validation of transport models using field experiments; corrosion and chemical processes in the near-field; and the role of sensitivity and uncertainty analysis.

13286 (NUREG/CP—0079, pp 411-417) **Lessons learned in the verification, validation and application of a coupled heat and fluid flow code.** Tsang, C.F. (Lawrence Berkeley Lab., CA). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

A summary is given of the authors recent studies in the verification, validation and application of a coupled heat and fluid flow code. Verification has been done against eight analytic and semi-analytic solutions. These solutions include those involving thermal buoyancy flow and fracture flow. Comprehensive field validation studies over a period of four years are discussed. The studies are divided into three stages: (1) history matching, (2) double-blind prediction and confirmation, (3) design optimization. At each stage, parameter sensitivity studies are performed. To study the applications of mathematical models, a problem proposed by the International Energy Agency (IEA) is solved using this verified and validated numerical model as well as two simpler models. One of the simpler models is a semi-analytic method assuming the uncoupling of the heat and fluid flow processes. The other is a graphical method based on a large number of approximations. Variations are added to the basic IEA problem to point out the limits of ranges of applications of each model. A number of lessons are learned from the above investigations. These are listed and discussed.

13287 (NUREG/CP—0079, pp 421-444) **Benchmarking NNWSI flow and transport codes: current results and activities.** Hayden, N.; Braitwaite, J.; Langkopf, B. (Sandia National Labs., Albuquerque, NM). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

This report discusses and compares results by different ground water models using the same scenarios for pollution source. Sensitivity analysis on the computer codes along with accuracy is compared through graphs and tables. A certification process for computer codes to perform risk assessments of high-level radioactive waste repositories is presented. Very little written text is provided.

13288 (NUREG/CP—0079, pp 447-463) **Channeling, matrix diffusion and redox capacity in crystalline rock - some questions in connection with the geologic barrier.** Neretnieks, I. (Royal Institute of Technology, Stockholm, Sweden). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

In Sweden and Switzerland two studies have recently (1983 and 1985) been published regarding the final disposal of nuclear waste in deep geologic formations in granitic rock at large depths. There is evidence that the bedrock at large depths is so sparsely fractured that it may not be possible to describe the flow by the normally used equivalent porous medium approach. The flow must be assumed to take place in individual channels within existing fracture planes or fracture zones. This has implications on the observability of the flow conduits and has consequences for the migration velocity and dispersion of the radionuclides. Available observations and their impact on radionuclide migration are discussed. In both studies it was concluded that the by far most important retardation mechanism for the nuclides is matrix diffusion. Past and present efforts to study this process are described. The importance of the natural redox buffer system of the rock to contain disturbances by intrusion of oxygen or due to radiolysis as well as the overall importance of a reducing environment to ensure low actinide solubilities and high sorption capacity of the rock is described.

13289 (NUREG/CP—0079, pp 465-488) **Geochemical sensitivity analysis for performance assessment of HLW repositories: effects of speciation and matrix diffusion.** Siegel, M.D.; Erickson, K.L. (Sandia National Labs., Albuquerque, NM). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

The objective of this geochemical sensitivity analysis is to use simple, approximate models to calculate upper bounds for radionuclide discharges and to identify physicochemical conditions where more rigorous theoretical transport calculations must be done. An approximate model is given for bounding discharges of radionuclides in porous rock in scenarios where radioactive production is negligible but decay is appreciable, and several nuclides of an element migrate and undergo a speciation reaction. The model is incorporated into a methodology to determine critical combinations of hydrological and chemical parameter values that result in discharges that violate the HLW standard proposed by the US Environmental Protection Agency (40CFR 191). As an example, the methodology is applied to the discharges of ^{243}Am and ^{237}Np from a reference repository. It also is shown how results from the sensitivity analyses can be used to develop criteria from designing laboratory experiments so that effects of significant speciation reactions will be detected. Approximate methods for calculating radionuclide discharge are given for extending these analyses to transport in fractured rock where diffusion of radionuclides into the matrix may occur.

13290 (NUREG/CP—0079, pp 491-495) **Degree of complexity of geohydrological models used in performance assessment.** Glasbergen, P. (National Institute of Public Health and Environmental Hygiene, Leidschendam, Netherlands). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

A proposal for the use of selected degrees of complexity of models is discussed. It is shown that 3-D models are needed in an early stage to determine the geochemical zones through which radionuclides will pass after release from a deep-lying repository. For a wide range of flow tubes produced by 3-D models, transport calculations based on 1-D models are required to explore relevant geochemical processes. This should reciprocally lead to an optimal program in terms of quality and costs of laboratory and field experiments.

13291 (NUREG/CP—0079, pp 499-526) **Uncertainty assessment for fluid flow and contaminant transport modeling in heterogeneous groundwater systems.** Nelson, R.W.; Jacobson, E.A.; Conbere, W. Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

There is a growing technical and public awareness of the need to quantify the uncertainty in subsurface performance assessments for waste repositories. Progress is described on methods that are being developed to complement and enhance the traditional fluid flow and transport modeling approach by considering uncertainty in the analysis sequence. The extended analysis begins by using field measurements of transmissivity and hydraulic head in a statistical parameter estimation method to obtained a calibrated fluid flow model and a covariance matrix of the parameter estimation errors. The calibrated model and the covariance matrix are next used in conditional simulation mode to generate a large number of head realizations. The specific pore velocity distribution for each realization is calculated from the effective porosity, the aquifer parameter realization, and the associated head values. Each velocity distribution is used to obtain a transport solution for the contaminant originating from the same source for all realizations. The results are the statistical distributions for the outflow arrival

times. The confidence intervals for contamination reaching the biosphere are obtained from the outflow statistical distribution.

13292 **(SAND—86-0954) Compilation of hydrologic data from drilling the Salado and Castile Formations near the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico.** Mercer, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004553.

This report compiles and evaluates data from tests performed on the Salado and Castile Formations during site characterization, exclusive of the "brine reservoirs" in the Castile. It also examines if regional data are consistent with the experience of fluid encounters in the mined facility - especially whether significant volumes of fluid might be involved in the Salado pressure buildups in the same way as small volumes were in the studies in the mined facility at the WIPP. Preliminary analyses of recently completed data from reentry and testing in WIPP-12 and testing of the Salado in DOE-2 are also included. Results of this study indicate that probably no overall interpretive model can be applied to the Salado and Castile Formations. That is, no definitive or unique explanation exists for the brine and/or gas occurrences or pressure buildups or their distribution in the borehole. Because of certain basic problems of well testing from the surface in low-permeability rock and because of the apparent low permeabilities, we do not recommend continued hydrologic testing conducted from the surface and penetrating the halites and anhydrites of concern at the WIPP. However, testing of the halite and marker beds at or near the WIPP mining horizon is practicable and should be carried out with the more sensitive instrumentation developed for that purpose. 31 refs., 3 figs., 12 tabs.

13293 **(SAND—86-7169) The ISHTE [In-Situ Heat Transfer Experiment] platform transponder and controller: Final report.** Miller, J.B.; Olson, L.O. (Washington Univ., Seattle (USA). Coll. of Ocean and Fishery Sciences). Dec 1986. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003046.

A team of engineers at the Applied Physics Laboratory, University of Washington has been working on an In-Situ Heat Transfer Experiment (ISHTE) to be performed in the sediments of the deep ocean. This experiment is part of the Subseabed Disposal Program sponsored by the US Department of Energy and managed by Sandia National Laboratories to assess the feasibility of using deep ocean sediments to store high-level nuclear waste. This is a final report of the work performed on ISHTE from July 1982-June 1986 under Contract 16-9970. A technical description of the electronic systems designed and built, and a list of relevant reports written by the APL Team are included.

13294 **(UCID—20895) Application of EQ3/6 to modeling of nuclear waste glass behavior in a tuff repository.** Aines, R.D. (Lawrence Livermore National Lab., CA (USA)). May 1986. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004456.

Modeling of glass degradation based on sound geochemical principles appears to be possible with revisions to EQ3/6. Realistic source terms for several repository scenarios may be generated with such a model. One scenario which appears very likely and which is also amenable to modeling using EQ3/6 is that in which an intact but perforated canister holds water in contact with waste glass. The water overflows continuously or periodically, allowing radionuclides to come in contact with repository rock. This isolated-type scenario will be the first realistic modeling effort because it limits complex interactions between rock and glass. However, EQ3/6 modeling should be possible even for very complicated scenarios if sufficient experimental data are available on rates and thermodynamics. This will be the limiting factor in progress toward modeling the complete system.

13295 **(UCRL—94708) Carbon-14 in waste packages for spent fuel in a tuff repository.** Van Konynenburg, R.A.; Smith, C.F.; Culham, H.W.; Smith, H.D. (Lawrence Livermore National Lab., CA (USA); Hanford Engineering Development Lab., Richland, WA (USA)). 14 Oct 1986. Contract W-7405-ENG-48. 14p. (CONF-861207—31). NTIS, PC A02/MF A01. File Number DE87004365.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Carbon-14 is produced naturally by cosmic ray neutrons in the upper atmosphere. It is also produced in nuclear reactors, in amounts much smaller than the global inventory. About one-third of this is released directly to the atmosphere, and the other two-thirds remains in the spent fuel. Both the Environmental Protection Agency and the Nuclear Regulatory Commission have established limits on release of the ^{14}C in spent fuel. This is of particular concern for the proposed repository in tuff, because of the unsaturated conditions and the consequent possibility of gaseous transport of ^{14}C as CO_2. Existing measurements and calculations of the ^{14}C inventory in spent fuel are reviewed. The physical distribution and chemical forms of the ^{14}C are discussed. Available data on the release of ^{14}C from spent fuel in aqueous solutions and in gaseous environments of air, nitrogen, and helium are reviewed. Projected ^{14}C behavior in a tuff repository is described. It is concluded that ^{14}C release measurements from spent fuel into moist air at temperatures both above and below the in situ boiling point of water as well as detailed transport calculations for the tuff geological environment will be needed to determine whether the 10CFR60 and 40CFR191 requirements can be met. 56 refs., 1 tab.

13296 **Achieving a negotiated compensation agreement in siting: the MRS case.** Sigmon, E.B. (Oak Ridge Associated Universities, TN). *Journal of Policy Analysis and Management;* 6: No. 2, 170-179(Win 1987).

Theoreticians claim that negotiated compensation plans could overcome local resistance to nuclear waste (or other less than desirable) facilities, and the Nuclear Waste Policy Act of 1982 gives the Department of Energy considerable flexibility to negotiate with and compensate states in which it locates waste storage. DOE's monitored retrievable storage (MRS) proposal is the first attempt under the NWPA to site nuclear waste operations, and both DOE and one local community tried the negotiated compensation approach with some success. State and regional leaders chose to oppose the project rather than to negotiate, however. The limited experience to date suggests that local reluctance to negotiate is a generic weakness of the compensation approach to siting and must be given greater attention.

13297 **Thermal conductivity measurements of Pacific illite sediment[1].** Sweet, J.N. (Sandia National Labs., Albuquerque, NM). *International Journal of Thermophysics;* 7: No. 4, 743-754(Jul 1986). (CONF-850617—).

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

Results are reported for effective thermal conductivity measurements performed in-situ and in core samples of illite marine sediment. The measurements were obtained during a recent oceanographic expedition to a study site in the north central region of the Pacific Ocean. This study was undertaken in-support of the U.S. Subseabed Disposal Project, the purpose of which is to investigate the scientific feasibility of using the fine-grained sediments of the sea floor as a repository for high-level nuclear waste. In-situ measurements were made and 1.5-m-long hydrostatic piston cores were taken, under remote control, from a platform that was lowered to the sea floor, 5844 m below sea level. The in situ measurement of thermal conductivity was made at a nominal depth of 80 cm below the sediment surface using a specially developed, line-source, needle probe. Thermal conductivity measurements in three piston cores and one box core (obtained several kilometers from the study site) were made on shipboard using a miniature needle probe. The in-situ thermal conductivity was approximately 0.91 $W \cdot m^{-1} \cdot K^{-1}$. Values determined from the cores were within the range 0.81 to 0.89 $W \cdot m^{-1} \cdot K^{-1}$.

13298 **Department of Energy authorizations for fiscal years 1986 and 1987. Oversight hearings before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, House of Representatives, Ninety-Ninth Congress, First and Second Sessions.** Washington, DC; Government Printing Office (1986). 357p.

Energy Secretary John S. Herrington, Kevin Boland of the General Accounting Office, and a panel of witnesses from DOE testified on DOE's budget request of $2.6 billion, an increase of $.3 billion over 1985 and a decrease of $.3 billion from 1984 appropriations. Critical programs include the Monitored Retrieval Storage (MRS) facility for high-level nuclear wastes and uranium enrichment. Herrington and DOE spokesmen defended the budget request and responded to committee questions. Boland reported that, while DOE has made progress in meeting the legislative requirements for the MRS program, it will be difficult to meet the repository siting deadlines and financing requirements for the program. Boland anticipated that legal challenges could delay the program. He also questioned DOE's decentralized field management approach. Two appendices with additional statements and responses submitted for the record follow the testimony.

13299 **Modeling the highway transportation of spent fuel.** Harrison, I.G. Knoxville, TN; Univ. of Tennessee (1986). 236p. University Microfilms Order No. 86-24,247.

Thesis (Ph. D.).

There will be a substantial increase in the number of spent fuel shipments on the nation's highway system in the next thirty years. Most of the spent fuel will be moving from reactors to a spent fuel repository. This study develops two models that evaluate the risk and cost of moving the spent fuel. The Minimum Total Transport Risk Model (MTTRM) seeks an efficient solution for this problem by finding the minimum risk path through the network and sending all the spent fuel shipments over this one path. The Equilibrium Transport Risk Model (ETRM) finds an equitable solution by distributing the shipments over a number of paths in the network. This model decreases the risk along individual paths, but increases society's risk because the spent fuel shipments are traveling over more links in the network. The study finds that there is a trade off between path risk and societal risk. As path risk declines, societal risk rises. The cost of shipping also increases as the number of paths expand. The cost and risk of shipping spent fuel from ten reactors to four potential repository sites are evaluated using the MTTRM. The temporary monitored retrievable storage (MRS) facility in Tennessee is found to be the minimum cost and minimum risk solution. When direct shipment to the permanent sites is considered, Deaf Smith, Texas is the least cost and least incident free transport risk location. Yucca Mountain, Nevada is the least risk location when the focus is placed on the potential consequences of an accident.

13300 **Evaluation of excavation-induced changes in rock permeability.** Kelsall, P.C.; Case, J.B.; Chabannes, C.R. (D'Appolonia Consulting Engineers Inc., Albuquerque, NM). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts;* **21**: No. 3, 123-135(Jun 1984).

The nature of the changes in permeability around an underground opening induced by blast-damage or stress-relief is an important factor in the design of nuclear waste repositories in rocks such as granite or basalt. Changes in stress and corresponding changes in rock mass hydraulic conductivity are analyzed for a circular shaft using simplifying assumptions regarding fracture geometry and initial stress state. Stress distributions around the shaft are calculated using closed-form solutions and are related to changes in hydraulic conductivity using a form of the cubic law for flow through fractured media. The analysis predicts that hydraulic conductivity may be increased, close to the wall of the opening, by two to three orders of magnitude over the far-field value solely in response to stress relief. The zone in which hydraulic conductivity is increased by at least one order of magnitude over the far-field value is limited to within one to two radii from the opening. Blasting may result in large increases in hydraulic conductivity immediately adjacent to an opening but blast damage may be limited to within 0.3 m of the opening using controlled blasting techniques with low perimeter charge weights. 44 references.

13301 **Shielded cells transfer automation.** Fisher, J.J. (E.I. duPont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). pp 139-146 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract AC09-76SR00001.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

Nuclear waste from shielded cells is removed, packaged, and transferred manually in many nuclear facilities. To reduce radiation exposure to operators, technological advances in remote handling and automation were employed. An industrial robot and a specially designed end effector, access port, and sealing machine were used to remotely bag waste containers out of a glove box. The system is operated from a control panel outside the work area via television cameras.

13302 **Review of science and technology for disposal of low-level waste on the seabed and high-level waste in the subseabed.** Anderson, D.R.; Boyer, D.G.; Hollister, C.D. (Sandia National Labs.). pp 166-182 of Proceedings of the fourth Pacific Basin nuclear conference. Vogt, E.W.; Ludgate, G.A. Toronto, Ontario; The Canadian Nuclear Association (1983). (CONF-830934—).

From 4. Pacific Basin nuclear conference; Vancouver, Canada (11 Sep 1983).

The technology exists for the safe disposal of low-level radioactive wastes onto the sea floor. For over 30 years, certain types of packaged low-level waste have been dumped into the ocean. During this time, national and international agencies issued guidelines to ensure that dumping operations follow environmentally sound procedures. To supplement these guidelines and provide for continuing research, member nations of the NEA also established the Research and Environmental Surveillance Program Related to Sea Disposal of Radioactive Waste. Recently, Japan studied the feasibility of dumping packaged low-level waste onto the ocean floor. Their tests indicate that low-level waste dumping introduces only a negligible amount of radioactivity into the ocean. The ocean may also be a suitable location for disposing of other forms of low-level waste such as radioactive soil and defueled nuclear submarines. Feasibility assessments show promising results, but no decisions have yet been made. Research into waste disposal also addresses the question of disposing high-level waste in the oceans. Swedish nuclear reactor owners plan to dispose of all types of radioactive waste in a repository excavated in granitic rock beneath the ocean. The SWG, a committee under the auspices of the Nuclear Energy Agency, is investigating the feasibility of burying properly packaged high-level waste in the sediments of the ocean floor. Although this effort is not complete, the group has not found any indications that buried waste would harm humans or the environment.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 13302, 13310, 14343

13303 **(CONF-870211—1) Excursion control at in situ uranium mines.** Staub, W.P. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004061.

From 9. annual symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (2 Feb 1987).

This paper summarizes excursions (uncontrolled movement of lixiviant beyond the ore zone) based on case histories of 8 in situ uranium mines (7 in Wyoming and 1 in Texas). These case histories were compiled from data provided by the US Nuclear Regulatory Commission, the Wyoming Department of Environmental Quality, and the Texas Department of Water Resources. Most of these data were provided to the above agencies by mining companies in response to regulatory requirements pertaining to licensing actions.

13304 **(ORNL/TM—10007) Radiological survey of the perimeter fence line of the former Cotter Site, Hazelwood, Missouri (LM002).** Carrier, R.F.; Cottrell, W.D. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87005290.

A radiological survey was conducted in 1983 by the Oak Ridge National Laboratory along the perimeter fence line of the former Cotter site at 9200 Latty Avenue, Hazelwood, Missouri. During the 1960s and 1970s, process wastes and residues generated by the production and refining of uranium materials were stored at the site (currently owned by the Jarboe Realty and Investment Company). Subsequent to the removal and transport of the stored wastes along with a portion of the top soil to other locations, it was found that the soil remaining on the site contained radioactive residuals. This report describes the survey of the regions along the fence line that surround the property on all sides. Included were: gamma scans of the grid blocks on each side of the fence line; sampling of surface soil; sampling of subsurface soil from auger holes; and gamma logging of auger holes. The results of soil sample analyses demonstrate radionuclide soil contamination with maxima for ^{226}Ra, ^{230}Th, and ^{238}U at 1700, 77,000 and 1200 pCi/g, respectively. These concentrations were found in surface soil taken from 0 to 0.15 m. The depth of contamination ranges from the surface to 1.7 m. The maximum contamination measured during this survey was found at an average depth of 0.36 m. 9 refs., 16 figs., 7 tabs.

13305 **(ORNL/TM—10062) Environmental data for the White Oak Creek/White Oak Lake watershed: Environmental Sciences Division publication No. 2779.** Sherwood, C.B.; Loar, J.M. (Oak Ridge National Lab., TN (USA)). Jan 1987. Contract AC05-84OR21400. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87005279.

Oak Ridge National Laboratory (ORNL) is located in the White Oak Creek (WOC) watershed, which drains approximately 16.8 km^2 (6.5 mile^2). The waters of WOC are impounded by White Oak Dam at WOC's intersection with White Wing Road (State Route 95), 1.0 km (0.6 mile) upstream from the Clinch River. The resulting White Oak Lake (WOL) is a small, shallow impoundment, whose water level is controlled by a vertical sluice gate that remains in a fixed position during normal operations. White Oak Creek has been utilized for the discharge of treated and untreated wastes from routine operations since the Laboratory's inception. In addition, most of the more recent (1954 to date) liquid and solid low-level-waste disposal operations have been located in the drainage area of WOC. As a federally owned facility, ORNL is required to comply with all existing federal, state, and local environmental regulations regarding waste management. On July 15, 1985, the US Environmental Protection Agency published final rules to incorporate changes in the Resource Conservation and Recovery Act of 1976 that resulted from the passage of the Hazardous and Solid Waste Amendments of 1984. As a part of the rule changes, a new Sect. 3004(u) was added. The new section requires that any facility permit issued after November 8, 1984, include planned corrective actions for all continuing releases of hazardous waste or constituents from any disposal unit at the facility, regardless of when the waste was placed at the disposal unit. This report was prepared to compile existing information on the content and quantity of hazardous substances (both radioactive and nonradioactive) in the WOC/WOL watershed and to provide background information on the geology, hydrology, and ecology of the site for use in planning future remedial actions. 109 refs., 45 figs., 33 tabs.

13306 **(ORNL/TM—10078) Large-scale leaching of low-level radioactive wastes: Environmental Sciences Division publication No. 2737.** Francis, C.W. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE87004058.

The large-scale leaching of low-level radioactive wastes was conducted using 208- and 314-L drums containing radioactive wastes generated at Oak Ridge National Laboratory and Oak Ridge Gaseous Diffusion Plant. Ten 208-L drums containing low-level transuranic (TRU) wastes and four 314-L overpack drums containing compacted drums from a Westinghouse-Hittman drum compaction demonstration were leached with potable drinking water, using a unique design to simulate the flooded conditions of a shallow-land burial site. The TRU drums selected were those that contained less than 3.7 kBq/G (100 nCi/g) of transuranics and less than 5 mR/h gamma radiation at the surface of the drum. Only one of the ten drums generated a leachate that contained detectable levels of alpha activity over a 27-d leaching period, with concentrations ranging from approximately 200 to 1200 Bq/L. Concentrations of inorganic and organic constituents were also monitored in the drum leachates. Maximum concentrations of organic compounds phenol, phthalates, bromodichloromethane, chlorodibromomethane, chloroform, chlorinated ethanes, and ethenes were quite low, usually on the order of 0.05 to 0.5 mg/L, indicating that the shallow-land disposal of these materials probably would not contaminate groundwater supplies with hazardous organic chemicals. Only one of the overpack drums generated leachates containing detectable concentrations of ^{137}Cs, ^{60}Co, and ^{90}Sr over 20 d of leaching. Another showed detectable levels of ^{90}Sr and another, detectable levels of alpha activity in their leachates. Concentrations of volatile organic compounds decreased rapidly on continued leaching, indicating that disposing of these low-level radioactive wastes in a shallow-land burial site probably would not contaminate the groundwater. A waste model was used to demonstrate how concentrations of leachable constituents from a waste can be estimated. 8 refs., 9 figs., 22 tabs.

13307 **Long-term environmental problems of radioactively contaminated land.** Baes, C.F. III; Garten, C.T. Jr.; Taylor, F.G.; Witherspoon, J.P. (Oak Ridge National Lab., TN). *Environment International;* 12: No. 5, 545-553(1986). Contract AC05-84OR21400.

This paper examines the various sources of radiological land contamination; its extent; its impacts on man, agriculture, and the environment; countermeasures for mitigating exposures; radiological standards; alternatives for achieving land decontamination and cleanup; and possible alternatives for utilizing the land. The major potential sources of extensive long-term land contamination with radionuclides, in order of decreasing extent, are nuclear war, detonation of a single nuclear weapon (e.g. a terrorist act), serious reactor accidents, and nonfission nuclear weapons accidents that disperse the nuclear fuels (termed broken arrows). Over the long-term, external radiation doses are dominated primarily by ^{137}Cs and internal radiation doses primarily by ^{90}Sr. Plutonium and the transuranic elements are also important, primarily because of their long half-lives and relatively high inhalation doses. Costs for cleanup of contaminated land are very high. For example, cleanup of the broken arrow in Palomares, Spain, was approximately $33,600 per hectare. If cleanup of agricultural land is impractical, alternative land uses might include production of fiber crops, seed-stock crops, or plant biomass for alcohol fuels, or diversion of the land from crop production. Conversion of cropland to pasture or rangeland takes benefit from the generally lower accumulation of radionuclides into animal products compared with plants products. Another alternative is to fence off the land and use it for production of timber. This alternative would allow for 25-100 y or more of radiological decay before recovery of the timber.

0540 Health And Safety

REFER ALSO TO CITATION(S) 13261, 13304

13308 **(EIR—569) Description of a plutonium incident in the Hot Laboratory on May 24, 1983, and the resulting consequences.** Hausmann, W.; Francioni, W.; Ingold, F.; Ledergerber, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzeriand)). Aug 1985. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780507.

At 16.15 on 24 May 1983 a rapid chemical reaction occurred in an apparatus in which a routine waste sludge evaporation process was under way. The waste was produced during fuel fabrication. The resulting pressure wave ruptured a number of parts at the glove box in which the equipment was situated leading to an alpha contamination of that and neighboring laboratories. The alarm system activated by the fire alarm, the activity detectors and manually by the operators functioned correctly. No one was physically

injured and thanks to immediate protecture measures (e.g., gas masks) the amount of alpha-dust incorporated could be limited in degree and extent. Very time-consuming and costly cleaning and decontamination procedures were found to be necessary but these led to the encouraging result that the greater part of the contaminated equipment (particularly electrical and electronic apparatus) could be released for further unrestricted use in open labs. Detailed tests with the original waste solutions showed that at a certain ammonium nitrate content and at 235 C an exothermic chemical reaction can occur in the sludge. This temperature can only be reached due to a defective apparatus (e.g., a broken glass vessel) allowing the sludge to contact the heating element directly. The external expert agrees that this is the most likely cause of the incident.

13309 (INIS-mf—10100, pp 3) **Computer assisted lung burden assessment on uranium workers at ASEA-ATOM.** Gustafsson, J.; Vaernild, O. (ASEA-ATOM AB, Vaesteraas, Sweden). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13310 **(KAERI/RR—451-4/84) Evaluation on the safety of solidified waste products and underground radionuclides movement.** Park, H.H.; Kim, K.H.; Cho, Y.H. (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). Apr 1985. 83p. (In Korean). NTIS (US Sales Only), PC A05/MF A01. File Number DE86780540.

Leaching rate of cement-solidified radwastes produced by the same method such as a Korean nuclear power plant was measured. An attempt was made to standardize the measurement method for the leached radionuclide concentration. And as for the underground radionuclide migration, analytical solution of the underground radionuclide transport equation was derived. Hydraulic conductivity and radionuclide sorption coefficients at clays were determined by a consolidation test and batch process. Simulation for the prediction of underground radionuclide migration was performed by using above experimentally determined values as input data.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 13492

13311 **(K/OA—6038) Investigation of technology for the monitoring of UF_6 mass flow in UF_6 streams diluted with H_2.** Baker, O.J.; Cooley, J.N.; Hewgley, W.A.; Moran, B.W.; Swindle, D.W. Jr. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Dec 1986. Contract AC05-84OT21400. 58p. (ISPO—259). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004145.

The applicability, availability, and effectiveness of gas flow meters are assessed as a means for verifying the mass flows of pure UF_6 streams diluted with a carrier gas. The initial survey identified the orifice, pitot tube, thermal, vortex shedding, and vortex precession (swirl) meters as promising for the intended use. Subsequent assessments of these flow meters revealed that two - the orifice meter and the pitot tube meter - are the best choices for the proposed applications: the first is recommended for low velocity gas, small diameter piping; the latter, for high velocity gas, large diameter piping. Final selection of the gas flow meters should be based on test loop evaluations in which the proposed meters are subjected to gas flows, temperatures, and pressures representative of those expected in service. Known instruments are evaluated that may be applicable to the measurement of uranium or UF_6 concentration in a UF_6 - H_2 process stream at an aerodynamic enrichment plant. Of the six procedures evaluated, four have been used for process monitoring in a UF_6 environment: gas mass spectrometry, infrared-ultraviolet-visible spectrophotometry, gas chromatography, and acoustic gas analysis. The remaining two procedures, laser fluorimetry and atomic absorption spectroscopy, would require significant development work before they could be used for process monitoring. Infrared-ultravioloet-visible spectrophotometry is judged to be the best procedure currently available to perform the required measurement.

13312 **(LA—10925-MS) Liquid sample shuffler for gamma active solutions.** Crane, T.W. (Los Alamos National Lab., NM (USA)). Feb 1987. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004774.

An instrument is proposed by Los Alamos National Laboratory for measuring low levels of fission-product-contaminated fissile solutions at the Idaho National Engineering Laboratory (INEL). The proposed unit uses neutrons from a ^{252}Cf neutron source to induce fissions, and delayed neutrons from the induced fissions are counted once the neutron source is withdrawn. Lead is used to shield the neutron detectors from the gamma-ray dose of the fission products found in the solutions at the INEL plant. The designed sensitivity is 5 mg/l of ^{235}U in 100 s with a 4-standard-deviation confidence.

13313 **(MLM—3411) Random and systematic errors of PVT/MS-TAM (Tritium Analysis Meter) measurements of tritium gas: Evaluation and use in material balance calculations.** Rudy, C.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 22 Dec 1986. Contract AC04-76DP00053. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004555.

Propagation-of-error calculations were performed for material balance areas for processes involving the handling of bulk quantities of tritium gas. Random and systematic error components were obtained from pressure, volume, temperature, and isotopic measurements performed by Mound measurement control and calibration programs. The resultant error components were used to determine the uncertainties in determinations of physical inventories and material flow through material balance areas.

13314 **(SAND—86-2602C) A vehicle identification system for surveillance applications.** Bukaty, M.E. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 5p. (CONF-870357—1). NTIS, PC A02/MF A01. File Number DE87002869.

From 2. topical meeting on machine vision; Lake Tahoe, NV, USA (18 Mar 1987).

Many surveillance applications require electronic imagers to provide real time or near real time pictures. An example might involve the security system of a sensitive facility where the monitoring of entering and exiting traffic is important. Since the objects of interest in this scenario are vehicles, it is possible to use a one-dimensional line scanner and let the vehicle self scan via its motion. The resulting image is two-dimensional with the vertical representing a spatial displacement and the horizontal time. This paper describes a self contained vehicle identification system which acquires images of moving objects, and classifies them utilizing edge extraction, shadow elimination, and Fourier Descriptors. 4 refs., 1 fig., 1 tab.

0560 Legislation And Regulations

13315 **(INIS-mf—10095) Order of 4 January 1985 on transport and handling of dangerous goods (amendment of Appendix I, labelling of the Regulations of 15 April 1945) (Dangerous goods 1985, No. 2).** (International Atomic Energy Agency, Vienna (Austria)). 6 Feb 1985. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780527.

This Order revises Appendix 7 of the Regulations of 15 April 1945 on the transport of dangerous goods. The amendments the Order has made concern labelling and markings and refer to several classes of substances, including class 7 which covers radioactive materials.

13316 (INIS-mf—10096) Decree No. 85-296 of 1 March 1985 publishing the Agreement between the Government of the French Republic and the Government of Australia on nuclear transfers (with four Annexes and an exchange of letters) signed in Paris on 7 January 1981. (International Atomic Energy Agency, Vienna (Austria)). 5 Mar 1985. 6p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780528.

This Agreement, which entered into effect on 12 September 1981, applies to nuclear material and non-nuclear material set out in the Annex, to be used in reactors, and to equipment and technology transferred between the two Parties, whether directly or through a third party. The transfer of such material to a party other than the recipient party, except in the case of France to European Community countries, cannot take place without the prior written authorization of the supplier party. The materials referred to in the Agreement remain subject to its provisions until they are no longer usable for any nuclear activity relevant from the point of view of the safeguards mentioned therein or until they have been transferred beyond the jurisdiction of the recipient party in accordance with the Agreement. The Agreement prohibits the use or diversion of such materials for the production of nuclear weapons or other nuclear explosive devices, or for use for any military purpose.

13317 (INIS-mf—10097) Statutory Instruments - 1984 No. 863 and 1985 No. 708. Public Health, England and Wales - Public Health, Scotland. The Control of Pollution (Radioactive Waste) Regulations 1984, The Control of Pollution (Radioactive Waste) Regulations 1985. (International Atomic Energy Agency, Vienna (Austria)). 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780529.

The Regulations provide that radioactive waste is to be treated as any other waste for pollution control purposes as opposed to special radioactive control purposes. In the former respect, radioactive waste is subject to Part II of the Control of Pollution Act 1974, but in the latter, it remains subject to the Radioactive Substances Act 1960.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

REFER ALSO TO CITATION(S) 13909

13318 (PB—87-140307/XAB) Cobalt-60 facilities available for hardness assurance testing. Final report. Humphrey, J.C.; Dozier, C.M. (National Bureau of Standards, Washington, DC (USA). Ionizing Radiation Div.). Nov 1986. 31p. (NBSIR—86/3480). NTIS, PC A03/MF A01.

The report contains a list of cobalt-60 gamma-ray irradiation facilities that are available for hardness assurance testing of electronic devices. A summary of source type, absorbed-dose rates, experimental volume available, and other pertinent information is given for each facility.

08 HYDROGEN

13319 (DOE/CE—0034/5) Hydrogen Energy Coordinating Committee: Annual report, Summary of DOE hydrogen programs for FY 1986. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Energy Storage and Distribution). Jan 1987. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003968.

The FY 1986 Summary is the ninth consecutive yearly report providing an overview of the hydrogen-related programs of the DOE offices represented on the Hydrogen Energy Coordinating Committee. A historical summary of the hydrogen budgets of these offices is given. Table 2a provides the distribution by mission-related program element for FY 1986, while Table 2b pertains to the non-mission-related activities. Total DOE funding in FY 1986 for mission-related hydrogen research was $3.3 million; DOE non-mission-related hydrogen research funding totaled $21.2 million. The individual program elements are described in the body of this report, and more specific program information is given in the Technology Summary Forms in Appendix A.

0801 Production

REFER ALSO TO CITATION(S) 13341, 13341

13320 (EUR—9477) Metal complexes as photosensitizers and relays for the redox decomposition of water. Ballardini, R.; Bignozzi, C.A.; Chiorboli, C.; Indelli, M.T.; Rampi, M.A.; Scandola, F.; Varani, G. (Commission of the European Communities, Luxembourg). 1984. 30p. Commission of the European Communities, Luxembourg.

New redox photosensitizers have been developed, among them several metal 8-hydroxy-quinoline complexes. Some of these are excellent excited-state reductants, with prominent visible absorptions, lifetimes in fluid solution in the microsecond range, and excited-state potentials around -1V vs. SCE. These photosensitizers are ideal for adsorption onto colloidal semiconductor particles. When used with Graetzel's bifunctional catalysts, they give rise to very efficient hydrogen production in sacrificial systems. A strategy has been also devised for the construction of bimetallic photosensitizers aimed at enhancing charge separation, based on the $Ru(bpy)_3(CN)_2$ chromophore. The search for new, inorganic, relay species resistant to catalytic hydrogenation has also been pursued. Caged metal ions have been shown to be excellent in this regard. The problem of cage escape in photochemical electron transfer reactions has been tackled on fundamental grounds. Effects of product charge type, distortional barriers, nonadiabaticity have been studied in order to rationalise available yields and arrive at the design of new high-efficiency cycles.

13321 (EUR—9526-EN) On the feasibility of integrating thermochemical processes for the decomposition of water in coal gasification. Final report. Preti, U.; Colussi, I.; Fermeglia, A.M.; Gallo, V.; Groppi, G.; Kikic, I.; Pomodoro, C.; Schmid, C. (Commission of the European Communities, Luxembourg. Directorate General Information Market and Innovation). 1984. 175p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Energy.

Two distinct parts from the study presented in this report: their common purpose is to increase hydrogen production in coal gasification processes with non traditional methods. In the first part it has been analysed to produce hydrogen by means of thermochemical cycles of water decomposition and taking advantage of gasification gas heat evolved in the entrained-bed reactor, which operates at high temperature (1700 to 1800 K). The second part deals with the analysis of recovering hydrogen from hydrogen sulphide, which forms in coal gasification, by utilizing processes derived from the 'Mark-13' thermochemical cycle of water decomposition conceived at the Joint Research Centre at Ispra.

13322 A hybrid quantum/thermal solar energy system for hydrogen production. Schell, D.; Karpuk, M.; West, R. (Solar Energy Research Institute, Golden, CO 80401). pp 360-363 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

A systems analysis of a hybrid quantum/thermal central receiver solar system has been performed to assess the possibility of producing hydrogen at a lower cost than from a thermal-only system acting alone. The cost of producing hydrogen by electrolysis is compared to the cost of producing hydrogen by the hybrid system. The hybrid system uses a beam splitter to separate the solar spectrum into short- and long-wavelength components for use by separate quantum and thermal receivers respectively. The thermal side of the plant utilizes the same conversion process as the thermal-only plant, while the quantum receiver uses a photoelectrochemical process for the direct conversion of sunlight into hydrogen. Details on the quantum receiver design and the photoelectrochemi-

cal process are discussed. The cost of hydrogen produced from the hybrid system (26/G3) is 13% lowe than from the thermal-only plant ($30/G3), with optimistic assumptions regarding the operation of the photoelectrochemical process and today's cost of solar central receiver systems. When more technically realizable assumptions are made there appears to be no advantage to choosing the hybrid system at this time.

0802 Storage

REFER ALSO TO CITATION(S) 13644

13323 (DGRST—79-7-1514) Study of the utilization of industrial iron titanium in order to store hydrogen under hydride form. Rebiere, J.; Mosse, M. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1982. 90p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE87750970.

Absorption capacity of industrial iron-titanium alloys is too low for hydrogen storage quenching or varying the ratio Fe/Ti has almost no influence. Aluminium is responsible for the low hydridation but aluminium content cannot be reduced without changing the fabrication process (thermit process). Addition of manganese to improve hydrogen storage has no effect probably because Al and Fe content is too high. 10 refs.

0805 Safety

13324 (EUR—9689-U.2) Elements for a hydrogen safety guide. Summary of existing texts. Jungbluth, C.; Langrognat, B.; Sauniere, J.; Siegler, F.; Tellier, C.; Thiery, C. (Commission of the European Communities, Luxembourg). 1985. 289p. (In French). Commission of the European Communities, Luxembourg.

The report seeks to outline the information to be provided in a "Hydrogen safety" guide, without in itself being a guide in the strict sense. This very broad subject is dealt within two main sections: a summary of existing texts and a section devoted to experiments and tests in a number of areas connected with hydrogen safety. The summary of existing texts covers in particular the reports which were the outcome of previous contracts concluded by the Commission of the European Communities on the same subject, as well as other existing data. The report deals with the following aspects of hydrogen and its use: properties, risks, typical problems, safety devices, acquired experience, recorded accidents, statistical data, and safety regulations. The second section contains the results of experiments and the corresponding conclusions regarding leak detection and detectors, inflammation and ignition factors, electrical equipment for use in zones where there is a risk of explosion, and fire prevention and fire fighting in the presence of hydrogen. The large number of tables, data and bibliographic references make this report a useful reference work even outside the field of safety.

13325 (EUR—9689-Vol.1) Elements for a hydrogen safety guide. Specific experiments, selection of apparatus and materials. Jungbluth, C.; Langrognat, B.; Sauniere, J.; Siegler, F.; Tellier, C.; Thiery, C. (Commission of the European Communities, Luxembourg). 1985. 409p. (In French). Commission of the European Communities, Luxembourg.

The report seeks to outline the information to be provided in a "Hydrogen safety" guide, without in itself being a guide in the strict sense. This very broad subject is dealt within two main sections: a summary of existing texts and a section devoted to experiments and tests in a number of areas connected with hydrogen safety. The summary of existing texts covers in particular the reports which were the outcome of previous contracts concluded by the Commission of the European Communities on the same subject, as well as other existing data. The report deals with the following aspects of hydrogen and its use: properties, risks, typical problems, safety devices, acquired experience, recorded accidents, statistical data, and safety regulations. The second section contains the results of experiments and the corresponding conclusions regarding leak detection and detectors, inflammation and ignition factors, electrical equipment for use in zones where there is a risk of explosion, and fire prevention and fire fighting in the presence of hydrogen. The large number of tables, data and bibliographic references make this report a useful reference work even outside the field of safety.

0806 Industrial And Commercial Use

13326 (CONF-860704—4) The industrial hydrogen and oxygen market in the Pacific Northwest. Blazek, C.F.; Donakowski, T.D.; Novil, M. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 13p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900447.

From 6. CERI world hydrogen energy conference; Vienna, Austria (20 Jul 1986).

The Federal Columbia River Power System is projected to have surplus hydroelectricity available during peak seasons for the next twenty years. Blocks of power averaging 2500 MW(e) in peak months at rates below 20 mills/kWh may be available. Under these conditions, electrolytic hydrogen becomes attractive if suitable markets exist. Objective of the analysis was to determine the market potential of large (>1 MW(e), advanced technology electrolyzers for industrial applications in the BPA service area. Industrial hydrogen and oxygen applications were identified based, in part, on current needs for hydrogen and the industry's regional energy demand. Hydrogen demand in these industries was assessed for both fuel and chemical needs. A questionnaire was sent to over 200 Pacific Northwest industrial sites. The report also discusses the regional environmental and regulatory issues and their potential impact on hydrogen and competing fuels. Cost factors which can affect the potential market for electrolytic hydrogen and oxygen were analyzed as well. One of the most important factors identified, in addition to electricity costs, was the by-product credit for the co-produced oxygen. A sufficient demand exists to warrant a concerted effort to introduce electrolyzers to potential users.

0808 Properties

13327 (AD-A—173898/8/XAB) Purification of hydrogen gas streams. Final technical report, 19 August 1985-18 May 1986. Wijmans, J.G.; Baker, R.W.; Louie, J.; Pfromm, P.H. (Membrane Technology and Research, Inc., Menlo Park, CA (USA)). Jul 1986. 47p. NTIS, PC A03/MF A01.

This report contains the results of a six-month feasibility study aimed at the development of high-flux palladium-silver membranes for purification of hydrogen gas streams. Membranes were prepared by coating palladium-silver layers onto a variety of support materials using a vacuum sputtering technique. The palladium-silver layers formed were generally less than 0.1 micron thick. Very finely porous or nonporous support materials were required to obtain high-quality membranes. The best membranes are extremely selective, with a hydrogen/nitrogen selectivity in the range 150 to 600. These selectivities, combined with hydrogen fluxes ranging from .0005 to .0001-cm3(STP)/cm²/sec/cmHg make the performance of these membranes far superior to any existing membranes. Consistent reproducibility of the membranes remained a problem to some extent throughout the program. However, it is anticipated that this could be overcome by refining the equipment and techniques used in preparation. Screening of more support materials and development of a better support structure would also be valuable in this respect. Taking these steps should enable high-flux, high-selectivity membranes to be produced consistently.

13328 (CEA-CONF—8576) Simple practical and theoretical classifications of H-corrosions, H-embrittlements phenomena and sensitive materials. Fidelle, J.P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1986. 10p. (CONF-8606168—3). NTIS (US Sales Only), MF A01. File Number DE87751296.

From NATO workshop on chemistry and physics of fracture; Bad Reichenhall, F.R. Germany (22 Jun 1986).

The main forms of hydrogen embrittlements and corrosion are discussed, they include: 1) embrittlement by dissolved hydrogen, 2) bulk hydrides by general corrosion, 3) solid embrittlement by local hydridation, 4) molecular gas embrittlement by precipita-

tion of a molecular gas under pressure. Metals affected by embrittlement due to hydrogen in solution and hydride effects are examined on Mendeleev's table. It appears that the metals are all A metals and for alloys, the alloying elements are A metals. A remarkable exception might be the case of alloys of Al (a III B element), however most of them contain the A element Mg.

13329 **Ignition by excimer laser photolysis of ozone.** Lucas, D.; Dunn-Rankin, D.; Hom, K.; Brown, N.J. (Applied Science Div., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 235 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract AC03-76SF00098.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The authors ignited mixtures of hydrogen, oxygen, and ozone in closed cells with 248nm radiation from a KrF excimer laser. Ozone, the only significant absorber in this system, dissociates after absorbing a single photon, and produces oxygen atoms which initiate combustion. A discretized, time-dependent Beer's law model has been developed and is used to demonstrate that the radical concentration profiles in the cell immediately after photolysis are dependent upon laser power, ozone concentration, lens focal length, and the separation between the lens and reaction cell.

13330 **The effects of obstacles, scale, and transverse venting on flame acceleration and transition to detonation.** Sherman, M.P.; Tieszen, S.R.; Benedick, W.B. (Sandia National Labs., Albuquerque, NM). pp 171 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Experimental results are reported for the combustion of hydrogen-air mixtures in a 30.5-m long, 136-m/sup 3/ volume channel, FLAME, and in an 8% linear scale model of the channel, MINIFLAME.

13331 **Theoretical studies on the reactions of atomic hydrogen with the peroxyl radical.** Harding, L.B. (Theoretical Chemistry Group, Chemistry Div., Argonne National Lab., Argonne, IL 60439). pp 99 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract W-31-109-ENG-38.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Ab initio electronic structure calculations have been used to characterize reactions of atomic hydrogen with the peroxyl radical.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 13028, 13029, 13883

13332 **(AD-A—174581/9/XAB) Photoassisted reaction of H_2 with CO_2 over solid catalysts. Technical report.** Lichtin, N.N.; Vijayakumar, K.M.; Rubio, B.I. (Boston Univ., MA (USA). Dept. of Chemistry). 14 Nov 1986. 16p. (TR—1). NTIS, PC A02/MF A01.

The dark and photoassisted reactions of CO_2 with H_2 over alpha-Fe_2O3, Zn-Fe-oxide, Co-Mo-Al-oxide, Co-Mo-Al-oxide, Co-Mo-Ti-oxide, platinized La-Ni-oxide and platinized $SrTiO_3$ were investigated in the absence and presence of water vapor. Illumination was by a Hg-Xe-lamp at wavelengths above 350nm. The incident light flux, measured by ferrioxalate actinometry, was (1.02 + or - 0.08) x 10^{17} power photons/sec. Reactants in the ratio of H_2:CO_2 = 2:1 were passed once over dry films of powdered catalysts at 30 C and latm with contact times of 1/2 or 1 min. Products were analyzed by gas chromatography. No reaction took place in the absence of catalyst. Catalyzed rates of production of products were constant over the 22-hr periods investigated. CO was the only product obtained in significant amounts in the dark. Under illumination, rates of formation of CO increased by a factor of 2 - 4.5. CH_4 was the only other product of the photoassisted reaction in the absence of water vapor, with yields less than 0.2 mole% of those of CO. In the presence of water vapor (3 mole% of supplied CO_2), formic acid was produced at rates up to 19 mole% the rate of formation of CO, along with minor amounts of CH_4, CH_2O and CH_3OH, all produced at rates less than 0.2 mole% that of CO. The highest photoassisted yields were obtained over Co-Mo-Al oxide, with efficiency of conversion of incident photons into products around 0.35 molecule of product/incident photon. The corresponding estimated quantum yield was 1 molecule of product/absorbed photon.

13333 **(CONF-860709—2) Anaerobic digestion of water hyacinth and sludge.** Biljetina, R.; Srivastava, V.J.; Chynoweth, D.P.; Hayes, T.D. (Institute of Gas Technology, Chicago, IL (USA); Florida Univ., Gainesville (USA); Gas Research Inst., Chicago, IL (USA)). 1986. 20p. IGT, 3424 South State Street, Chicago, IL 60616. File Number TI87900439.

From Conference on research and applications of aquatic plants for water treatment and resource recovery; Orlando, FL, USA (20 Jul 1986).

The Institute of Gas Technology (IGT) has been operating an experimental test unit (ETU) at the Walt Disney World (WDW) wastewater treatment plant to demonstrate the conversion of water hyacinth and sludge to methane in a solids concentrating (SOLCON) digester. Results from 2 years to operation have confirmed earlier laboratory observations that this digester achieves higher methane yields and solids conversion than those observed in continuous stirred tank reactors. Methane yields as high as 0.49 m^3 kg^{-1} (7.9 SCF/lb) volatile solids added have been obtained during steady-state operation on a blend of water hyacinth and sludge. 9 refs., 5 figs., 5 tabs.

13334 **(CONF-8604218—4) Gasification of wood wastes in the RENUGAS process.** Evans, R.J.; Onischak, M.; Knight, R.A.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). 1986. Contract AC02-80CS83004. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003957.

From American Gas Association: distribution/transmission conference; Chicago, IL, USA (28 Apr 1986).

The Institute of Gas Technology is developing the RENUGAS pressurized fluidized-bed biomass gasification process. The process research unit (PRU), built for this purpose, is 11.5-in. ID and designed for operation at up to 1800°F and 515 psia. It is capable of handling biomass feed rates up to 12 tons per day. Adiabatic, pressurized, fluidized-bed steam and oxygen-blown biomass gasification tests were conducted in the process research unit (PRU) to develop process optimization information for the production of medium-Btu gas. The test program has investigated the effect on gasification performance of temperature, pressure, biomass throughput rate, steam-to-biomass ratio, type of feedstock, feedstock moisture, and fluidized-bed height. Long-duration gasification tests (up to 3 days of steady-state operation) were made to establish material and energy balances, to observe the possible breakthrough of low-concentration organic compounds, and to evaluate the mechanical performance of the system. Test results indicate that the process, which has proven to be simple to operate, can achieve carbon conversions of about 95% with thermal efficiencies of about 75% and with low oil and tar production. New information on the oil and tar fraction production outline the effect of process operating conditions and feedstock type. Different feedstocks of very similar elemental compositions have produced similar product gas compositions but have produced different distributions and character of the oil and tar fractions. This information is important environmentally and impacts upon the scope and duty of process cleanup equipment. 2 refs., 10 figs., 5 tabs.

13335 **(EUR—9748) AVSA biomass gasification project.** Masson, H.A. (Commission of the European Communities, Luxembourg). 1985. 84p. (In French). Commission of the European Communities, Luxembourg.

A simplified design has been proposed for a small-scale fluid bed combustor-gasifier system. Bench scale cold test facilities have been used to optimise the operating parameters by a thermal tracing technique. Circulating rates as high as 1000 kg/s m^2 have been achieved. The selected fuel consists of biomass pellets: combustion rate and segregation tendencies have been determined in small-scale units. Thermogravimetry and thermal differential analyses have been used in an air and in a N_2-CO_2 atmosphere to define the heat of the main reactions and the temperatures at which they take place. Steam gasification has been studied in a micropilot heated fluid bed. It produces a gas containing about 40% H_2. A pilot unit (200 kg/h) has been constructed and the combustion cell has been operated successfully. Combustion efficiencies as high as 97.8% were obtained, while the thermal efficiency is approximately 83%.

13336 **(FRNC-TH—1894) Study of the transformation of naphtenes with catalytic reforming catalysts.** Abdeladim, A. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). 1982. 133p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE87750974.

The production of a high octane rating hydrocarbon base for petrol along with aromatic compounds for petrochemistry is the present day and future vocation of catalytic reforming. If one considers the nature of the reagents present in the treated loads, one notices that the naphtenes which are likely to lead to the desired aromatics, make up a large part. Experimental techniques and preliminary tests are described. Catalytic effect of platinum alone or with another metal (iridium or indium or rhenium or tin) on alumina support and effect of impurities (chlorine and coke) are examined. Experimental study of the dehydrogenation of cyclohexane and kinetic study of the transformation of cyclopentane naphtenes are presented. 82 refs.

13337 **(GRI—86/0134) RefCoM: Proof-of-concept experiment: Final report (1978-1985).** Mooij, H.P.; Pfeffer, J.T. (Waste Management Energy Systems, Inc., Tampa, FL (USA); Gas Research Inst., Chicago, IL (USA)). Jul 1986. Contract AC02-76CS20038. 147p. NTIS, PC A07. File Number DE87004284.

This report presents the results of a Proof-of-Concept-Experiment on a biological process for the production of a substitute natural gas from municipal solid waste. Construction of a facility with a nominal capacity of 100 ton/day of as received refuse was completed in May, 1978. After the initial mechanical shake-down, plant operations was initiated in November, 1978. Numerous mechanical and operational difficulties were encountered in the refuse processing subsystem. A variety of problems were identified and solution developed. However, all of these problems were not resolved sufficiently to obtain a sustained gas production until the fall of 1981. The installation of a completely new refuse separation system in 1982 permitted the continuous feeding of the anaerobic fermenters. The performance of the fermenters when continuous feeding was initiated was equal to or better than predicted from the laboratory data. Methane yields as high as 5.5 SCF/lb volatile solids fed were obtained at the thermophilic fermentation temperature. Fermenter operational problems were identified and corrected. Dewatering of the fermenter slurry was most effective with a belt-press filter. 16 refs., 3 figs., 12 tabs.

13338 **(NP—7770058) Development and synthesis behaviour of Fischer-Tropsch catalysts on an iron/manganese oxide basis.** Malessa, R. (Bochum Univ. (Germany, F.R.). Abt. fuer Chemie). 21 Mar 1985. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87770058.

Fe/Mn catalysts of different composition were used for CO hydrogenation (Fischer-Tropsch synthesis). Their activities and selectivities were determined in an integral catalytic fixed-bed reactor. Supplementary investigations of the texture and structure of these catalysts were carried out by means of N/sub 2/ and CO adsorption, X-ray diffraction, and Moessbauer effect spectroscopy.

13339 **Effect of catalysts on wood-gasification tar composition.** Elliott, D.C.; Baker, E.G. (Pacific Northwest Lab., Richland, WA). *Biomass;* **9**: No. 3, 195-203(1986).

Catalysts have been used in wood steam-gasification to increase the rate of gasification, modify product gas composition and to decompose tar byproduct to gas. This paper describes the use of catalytic materials both in the steam-gasification reactor and in a secondary gas treatment bed. The catalysts, potassium carbonate and a supported nickel metal catalyst, are shown to have large effects on the amount of byproduct tar formation but also to have a significant effect on the byproduct tar composition. Four cases are compared, uncatalyzed steam-gasification, potassium-catalyzed steam-gasification, potassium-catalyzed steam gasification followed by a nickel metal tar decomposition bed. Product gas in each case was scrubbed in methylene chloride and the scrubbing solution was analyzed by gas chromatography/mass spectrometry. The changes in tar composition are attributed to preferential cracking of different functional groups. The alkali was found to have a more generalized effect while the nickel appeared to be more specific for deoxygenation with reduced activity toward decomposition of aromatic hydrocarbons. 10 references.

13340 **Flash pyrolysis of biomass with reactive and non-reactive gas.** Steinberg, M.; Fallon, P.T.; Sundaram, M.S. (Brookhaven National Lab., Upton, NY 11973, USA, Process Sciences Div. of Applied Science). *Biomass;* **9**: No. 4, 293-315(1986).

The process chemistry of the flash pyrolysis of biomass (wood) with the reactive gases H2 and CH4 and with the non-reactive gases He and N2 is determined in a 1-in downflow tubular reactor at pressures from 20 psi (138 kPa) to 1000 psi (6.9 kPa) and temperatures from 600 to 1000 degrees C. With hydrogen, flash hydropyrolysis leads to high yields of methane and CO which can be used for SNG and methanol fuel production. With methane, flash methanolysis leads to high yields of ethylene, benzene and CO which can be used for the production of valuable chemical feedstocks and methanol transportation fuel. At reactor conditions of 50 psi (345 kPa) and 1000 degrees C and approximately 1 s residence time, the yields based on pine wood carbon conversion are up to 30% for ethylene, 25% for benzene and 45% for CO, indicating that over 90% of the carbon in pine is converted to valuable products. Pine wood produces higher yields of hydrocarbon products than Douglas fir wood; the yield of ethylene is 2.3 times higher with methane than with helium or nitrogen, and for pine the ratio is 7.5 times higher. The mechanism appears to be a free radical reaction between CH4 and the pyrolyzed wood. There appears to be no net production or consumption of methane. A preliminary process design and analysis indicates an economically competitive system for the production of ethylene, benzene and methanol based on the methanolysis of wood. (Refs. 8).

13341 **Direct use of natural gas for conversion of carbonaceous raw materials to fuels and chemical feedstocks.** Steinberg, M. (Brookhaven National Laboratory, Upton, NY, US. Dept. of Applied Science). *International Journal of Hydrogen Energy;* **11**: No. 11, 715-720(1986).

It appears that natural gas is almost as abundant as petroleum, if not more so, as a natural resource in many parts of the world. Because of its rich hydrogen content, it is probably the lowest cost source of hydrogen wherever it is available. It is proposed to use natural gas in conjunction with coal and biomass to produce the preferred liquid fuel simulating petroleum products. Processes are described which include methanolysis, i.e. the direct use of methane for gasification and liquefaction of coal and biomass, and for desulfurization of coal derived liquid and gases. The thermal decomposition of methane is described for hydrogen and carbon particulate production. A cyclical process is described for producing a clean particulate carbon from coal for use in a carbon-water fuel mix as a substitute diesel fuel or premium-grade boiler fuel. The hydrogen from methane can be used for flash hydropyrolysis or to produce ammonia fertilizer.

13342 **Fuel oils from higher plants.** Calvin, M. (Univ. of California, Berkeley). pp 147-160 of Proceedings of plant products and the new technology. Fuller, K.W.; Gallon, J.R. (eds.). Oxford, England; Oxford University Press (1985).

A discussion is presented with sections covering sugar cane, seed oils (e.g. palm oil), herbaceous plants (e.g. Euphorbia lathyris, Asclepias speciosa), hydrocarbon producing trees (e.g. terpenes

from fruit and foliage of Eucalyptus globulosa and the fruit of Pittosporum resiniferum and Pittosporum undulatum, and oil from Copaifera multijuga), biosynthetic pathways, and oil producion by algae. 56 references.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 13880, 14391

13343 **(PB—87-109294/XAB) Farm-scale ethanol plant for New Zealand. Stage 3: plant operation.** (Applied Combustion Systems Ltd., Rangiora (New Zealand)). May 1986. 72p. NTIS, PC PC E04/MF E01.

The report describes the operation of a farm ethanol plant, the project being Stage 3 of a wider study of the applicability of such a plant. The plant was sited at Sheffield in Canterbury and drew on the local crops of barley, potatoes, and wheat as feedstock. The report concentrates on the practical aspects of plant operation. The most significant factor affecting the viability of the project was the energy cost in opepating an electric boiler. To reduce the cost, a low-unit-rate night-time electricity tariff was essential. To meet this a large measure of automatic control was found necessary for the batch-distillation process. The best yields of ethanol obtained were: for barley, 265 litres/ton; for potatoes, 98 litres/ton; energy consumption was 11 kWh/litre. The overall conclusion is that the small scale of operation and the high energy and labour costs make the economics of such a venture unattractive.

13344 **(PB—87-117107/XAB) Final technical and economic feasibility report of a proposed alternative fuels alcohol distillation/anaerobic digestion system (K-D Stockyards Station).** (Siouxland Interstate Metropolitan Planning Council, Sioux City, IA (USA)). Mar 1986. 139p. NTIS, PC A07/MF A01.

The report details the findings of feasibility study for an alcohol plant/anaerobic digestion system at the K-D Stockyards Station in Sioux City, Iowa. The study covers location analysis, site analysis, engineering analysis (including boiler systems), economic analysis and manure analysis.

13345 **Magnesium limitation and its role in apparent toxicity of ethanol during yeast fermentation.** Dombek, K.M.; Ingram, L.O. (Univ. of Florida, Gainesville). *Applied and Environmental Microbiology;* **52**: No. 5, 975-981(Nov 1986).

The rate of ethanol per milligram of cell protein begins to decline in the early stage of batch fermentation before high concentrations of ethanol have accumulated. In yeast extract-peptone medium (20% glucose), this initial decline appears to be related to growth and to result in part from a nutrient deficiency. The addition of yeast extract, peptone, and ashed preparations of these restored the ability of glucose-reconstituted medium (in which cells had been previously grown) to support vigorous growth. Magnesium was identified as the active component. Supplementing fermentations with 0.5 mM magnesium prolonged exponential growth, resulting in increased yeast cell mass. The addition of magnesium also reduced the decline in fermentative activity (micromoles of CO_2 evolved per hour per milligram of protein) during the completion of batch fermentations. These two effects reduced the time required for the conversion of 20% glucose into ethanol by 1/3 with no measurable loss in ethanol yield (98% of theoretical maximum yield). It is possible that some of the reported beneficial effects of complex nutrients (soy flour and yeast extract) for ethanol production also result from the correction of a simple inorganic ion deficiency, such as magnesium.

13346 **A comparison of the high-temperature oxidation characteristics of simple alcohol fuels.** Norton, T.S.; Dryer, F.L. (Dept. of Mechanical and Aerospace Engineering, Princeton Univ., Princeton, NJ 08544). pp 267 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The use of alcohols both as pure fuels and as fuel extenders and octane enhancers in gasoline blends has been increasing in recent years in various parts of the world. Although it is widely recognized that alcohol fuels have high octane numbers, the fundamental chemical processes responsible for their resistance to autoignition are not yet well understood. Methanol is the only alcohol for which comprehensive chemical kinetic mechanisms have been developed. While preliminary modeling work has been done for ethanol, none has yet been undertaken for the larger alcohols.

13347 **Chemical kinetic modeling of the ethanol oxidation mechanism.** Norton, T.S.; Dryer, F.L. (Dept. of Mechanical and Aerospace Engineering, Princeton Univ., Princeton, NJ 08544). pp 95 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The chemistry of the gas-phase decomposition of ethanol has been the subject of numerous studies over the last thirty years. However, a comprehensive chemical kinetic mechanism for ethanol has yet to be developed. Most of the early studies were conducted in static reactors at low temperatures (25-600 C), under which conditions acetaldehyde was observed to be the only dominant intermediate species formed. Since earlier studies have demonstrated that ethylene does not form in any significant amounts from acetaldehyde, it is likely that both acetaldehyde and ethylene form directly from ethanol. This observation helps to explain why a preliminary model for the ethanol mechanism, which did not incorporate direct ethylene formation, was not very successful in reproducing the observed ignition delays for high-temperature shock tube oxidation experiments.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 14012, 14013, 14014

13348 **(EPRI-CS—4900-SR) Proceedings: Municipal solid waste as a utility fuel.** (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 321p. (CONF-8511251—). NTIS, PC A14/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. File Number DE87003411.

From Municipal solid waste as a utility fuel; Madison, WI, USA (20 Nov 1985).

The seminar "Municipal Solid Waste as a Utility Fuel," was held in Madison, Wisconsin, November 20-22, 1985 and was attended by more than 90 representatives from utilities, equipment vendors, and federal, state, and municipal governments. The papers presented at the seminar addressed mass burning of municipal solid waste (MSW) and semi-suspension firing of refuse-derived fuel (RDF) in dedicated boilers; preparation and cofiring of RDF with coal in utility boilers; guidelines for design and operation of RDF preparation, handling, and cofiring equipment at utility power plants; and the environmental issues of refuse-to-energy technology.

13349 **Fuelwood procurement for an industrial power plant; Dow Corning, a case study.** Folger, A.G.; Sworden P.G. (Renewable Resource Assessment and Instrumentation Branch Solar Energy Research Inst., Adden, CO, USA; Dow Corning Corp. Midland, MI, USA, Natural Resources Dept.). pp 148-155 of Proceedings of FPRS industrial wood energy forum '83, No. 7, Vol. 1. Robertson, D. (ed.). Madison, WI; Forest Product Research Society (1985). (CONF-830960—).

From Industrial wood energy forum '83; Nashville, TN, USA (19 Sep 1983).

Dow Corning Corporation has developed effective procedures for meeting the fuelwood requirements of a 22.4 megawatt steam and electricity cogenerating power plant. The fuelwood procurement program of Dow Corning's Natural Resources Department involves special arrangements with private landowners, logging and hauling producers, and waste wood suppliers. The program's success is attributable to a favorable location, adequate allowance for advance planning, effective public relations, and flexible management. The program is significant because it demonstrates that industrial fuelwood requirements can be met and that

improved production from nonindustrial private forests can be relied upon as a major source of fuelwood. (Refs. 7).

0906 Gaseous Waste Fuels

REFER ALSO TO CITATION(S) 13334

13 HYDRO ENERGY

1306 Environmental Aspects

13350 **(PB—87-116125/XAB) Simulations of the effects of minimum-discharge schedules on the oxygen concentration of the discharge of Conowingo Dam. Final report.** Dwyer, R.L.; Turner, M.A. (Martin Marietta Environmental Systems, Columbia, MD (USA)). Apr 1986. 102p. NTIS, PC A06/MF A01.

It has been suggested that there may be an optimum discharge regime for the Conowingo Dam that may allow the discharge waters to meet the Maryland water-quality standard for dissolved oxygen (DO). To test the efficacy of various minimum-discharge regimes, existing simulation models of Conowingo Reservoir and the nontidal river below the dam were linked together by a numerical procedure. Specifically, the linking procedure converted the output from the Conowingo Reservoir model (daily average DO concentrations in the surface and bottom layers of the reservoir) into 15-minute or hourly values. Those values then served as inputs to an empirical procedure for the withdrawal of water from the reservoir by the dam's turbines. The withdrawal model estimated the relative amounts of water withdrawn from each of the reservoir layers as turbine discharge increased. Waters from the layers were mixed to make up the discharge water. Typical summer operating patterns, constrained by the minimum discharge requirements were tested. It was concluded that no feasible changes in operating regimes alone would allow the discharge DO to meet the State standard of 5 mg/l.

14 SOLAR ENERGY

1401 Resources And Availability

13351 **Relationship between global radiation and cloudiness in southern Alaska.** Wendler, G.; Kodama, Y. (Univ. of Alaska, Fairbanks). *Solar Energy;* **36**: No. 5, 431-435(1986). Contract FG06-77ET20181.

Radiation data for Alaska are sparse. Hence, empirical relationships between global radiation and the amount of cloudiness, using cloudiness as a predictor, serve a useful function. In southern Alaska there have been two series of observations: an historical one in Annette; and the present one of 28-month length in Kodiak. The authors developed a regression relationship for Kodiak and tested it against Annette. A satisfactory relationship was established. A correlation factor of 0.995 was found for monthly mean values between the observed data from Annette and the calculated one using the relationship developed for Kodiak. This gives the opportunity to calculate the global radiation for other communities in south Alaska, where no radiation data exist.

13352 **Empirical corrections to a rotating shadowband silicon cell pyranometer.** Michalsky, J.; Harrison, L.; LeBaron, B. (Pacific Northwest Lab., Richland, WA 99352). pp 177-179 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Empirical corrections to a silicon cell pyranometer are derived. The corrections cause the silicon cell pyranometer to closely mimic the output of thermopile instruments. Daily integrated total horizontal, diffuse horizontal, and direct normal irradiances are within 1%, 3%, and 2.5% of thermopile values on the average. Ten-minute integrated values of these same silicon cell components seldom differ by more than 20 watts/m/sup 2/ from their thermopile counterparts. This paper is a report on our efforts to develop radiometric corrections for a rotating shadowband pyranometer using a silicon cell detector. Measurement systems using first-class pyranometers and pyrheliometers are expensive to buy and expensive to maintain, especially if one uses microprocessor-based trackers and data acquisition systems, and consequently inhibits widespread solar resource assessment.

13353 **Spectral distribution and variation of solar radiation.** Michalsky, J.J. (Pacific Northwest Lab., Richland, WA 99352). pp 52-58 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC06-76RL01830.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Measurements of the solar resource have long been made with pyranometers and pyrheliometers. Few, however, have attempted to measure the resource with any appreciable spectral resolution. In this paper, several of the solar technologies that could use a spectral data base are described. This is followed by an explanation of how the atmosphere affects the transport of extraterrestrial solar radiation. Present attempts to model these atmospheric effects and current measurement plans for obtaining a minimal data base of low spectral resolution data are presented. Finally, suggestions for improving the current state of spectral resource assessment are offered.

1403 Economics

REFER ALSO TO CITATION(S) 13390

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 13357

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 13320, 13335, 13339, 13340, 13342, 13343, 13349, 14300

13354 **(AD-A—173727/9/XAB) Analysis of impurity-band formation and related effects near the p/n junction in compensated GaAs and Si. Final report, July 1985-March 1986.** Brown, L.C. (Dayton Univ., OH (USA). Research Inst.). Sep 1986. 294p. NTIS, PC A13/MF A01.

This report contains the results of applying the bandgap narrowing model to studying the dopant concentration changes near the p/n junction of semiconductor parameters that have a direct effect on current-voltage characteristics. The report describes the method of compute modeling and analysis and the important conclusions reached. Of significance is the explanation of compensated semiconductor material behavior vs temperature and its implication for solar cells and microwave detectors.

13355 **(BAE-TP—071) HPSA: High power solar array study. Final report.** Lee, C.P. (British Aerospace Dynamics Group, Bristol (UK)). Jul 1985. 156p. (ESA-CR(P)—2201; ETN—86-98086). NTIS, PC A08/MF A01.

A 30 kW solar array design for ESA's Columbus program was established. Realistic array requirements were identified using the ESA recommended designed reference mission. System and subsystem level studies lead to preferred design solutions for silicon and gallium arsenide cell technologies. A development philosophy and test plan to pursue the identification of critical aspects was derived and a preliminary cost appraisal was made. It is concluded that a planar double roll out array employing silicon cells represents the most attractive solution, with a gallium arsenide roll out as a logical derivative.

13356 **(BMFT-FB-T—86-091) Development of a CdSe thin film solar cell. Final report.** Richter, H.; Rickus, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Dec 1986. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87751155.

The R and D work on CdSe MIS thin-film solar cells conducted in recent years has resulted in an AMI efficiency of over 7% at 0.6 cm/sup 2/ active area. The short-circuit current density of about 20 mA/cm/sup 2/ achieved with CdSe/sub 0.95/Te/sub 0.05/ cells corresponds to ca. 80% of the theoretical maximum value. The I layer, which affects mainly the open-circuit voltage, and the fill factor of the cell consists of ZnSe. Low-level Cu doping of this layer significantly enhances the fill factor. Irradiation with UV light ($h.\nu > 3.5$ eV, > 10 min) increases the open-circuit voltage and - slightly - the fill factor, resulting in values of about 0.6 V and up to 60%, respectively. Investigations on electrochemical solar cells on the basis of our polycrystalline CdSe films and CdSe single crystals using an Fe/sup III/(CN)/sub 6//Fe/sup II/(CN)/sub 6/ electrolyte led to open-circuit voltages of 1 V and indicate the development potential of the CdSe cell. Excellent stability and simple production techniques (standard high vacuum evaporation) of the CdSe thin-film cell, combined with low material consumption (2-3 μm thick), give rise to definite expectations for low-cost solar cells of an efficiency above 10%. With 39 refs., 43 figs.

13357 **(BNL—38777) Control of toxic gas release during the production of copper-indium-diselenide photovoltaic cells.** Fowler, P.K.; Dobryn, D.G.; Lee, C.M. (Massachusetts Inst. of Tech., Brookhaven, NY (USA). School of Chemical Engineering Practice-Brookhaven Station; Brookhaven National Lab., Upton, NY (USA)). Mar 1986. Contract AC02-76CH00016. 53p. (MIT/BNL—86-4). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004604.

Toxic gas control systems will be needed to treat both routine and accidental H_2Se and H_2S emissions from manufacturing facilities producing $CuInSe_2$ photovoltaic cells. In this study, routine and accidental environmental control options were evaluated for a manufacturing plant with an annual production of cells capable of generating 10 MWp. A routine emissions treatment facility was designed which uses a venture scrubber, a packed-bed scrubber, and a carbon adsorption bed to reduce emissions to allowable limits. This facility incrementally increases the cost of manufacturing $CuInSe_2$ photovoltaic cells by 0.60 cents/Wp. Two alternative systems were designed to handle an accidental release: a packed-bed scrubber/carbon adsorption bed, and a containment scheme followed by carbon adsorption. The incremental costs of manufacturing for these release systems are 0.91 cents/Wp and 1.25 cents/Wp, respectively.

13358 **(BNL—38815) Characterization of circular differential selective scattering in randomly and magnetically oriented chloroplasts and light harvesting chlorophyll a/b aggregates.** Garab, G.; Faludi-Daniel, A.; Sutherland, J.C.; Hind, G. (Brookhaven National Lab., Upton, NY (USA); Magyar Tudomanyos Akademia, Szeged. Biologiai Kutato Koezpontja). 1986. Contract AC02-76CH00016. 15p. (CONF-860808—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002586.

From 7. international congress on photosynthesis; Providence, RI, USA (10 Aug 1986).

Comparative circular dichroism studies were carried out in chloroplasts and the aggregated chlorophyll a/b light harvesting pigment protein complex (LHC). Much of the intense circular dichroism (CD) signal of chloroplasts and that of aggregated, isolated LHC were found to originate in circular differential light scattering (CDS). The difference spectra obtained between the CD spectra of randomly and magnetically oriented thylakoids resembled the selective light scattering spectra of chloroplasts. Furthermore, orientation-dependent changes in the CDS signal outside the principal absorbance bands were correlated with changes in the non-selective forward light scattering. These results provide evidence of a significant contribution by CDS to the CD spectrum of chloroplasts. A comparison between the CD signals of chloroplasts and aggregated LHC revealed that both preparations exhibit "anomalous" CD bands. The spectral shape and amplitude of these bands are changed dramatically upon magnetic alignment of the particles. These similarities are suggestive of the existence of similar helical domains in chloroplasts and the isolated LHC aggregate; hence our experimental results support the hypothesis of Faludi-Daniel and Mustardy that the LHC in the thylakoid membrane is aggregated in a liquid crystal-like structure resembling that which self-assembles in vitro. 17 refs., 4 figs.

13359 **(CONF-870201—2) Carbon budgets of Quercus rubra L. seedlings at selected stages of growth: Influence of light.** Hanson, P.J.; Isebrands, J.G.; Dickson, R.E. (Oak Ridge National Lab., TN (USA); Forest Service, Rhinelander, WI (USA). North Central Forest Experiment Station). 1986. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004260.

From Central hardwood forest conference; Knoxville, TN, USA (24 Feb 1987).

To determine potential growth responses of northern red oak (Quercus rubra L.) seedlings to various field light environments, carbon budgets of one-, two-, and three-flush seedlings were calculated. Leaf carbon dioxide exchange rate (CER), root respiration, and growth analysis provided inputs for the budgets. Daily CO_2 assimilation rates obtained from these budgets were lower than, but consistent with, actual red oak seedling growth rates. The budgets predicted that optimum daily CO_2 assimilation occurs under saturating irradiances in the absence of other stresses (e.g., drought), and that daily CO_2 assimilation is inadequate to match seedling respiration under the shade of a typical closed forest canopy. Calculated minimum incident photosynthetic photon flux densities required for sufficient CER to balance daily seedling respiration ranged from 30 to 150 μmol photons m^{-2} s^{-1}, depending on plant size. 44 refs., 7 tabs.

13360 (ESA-SP—38, pp vp) **Influence of fiber orientation and boundary conditions on the dynamic behavior of a cylindrically telescoping solar array (INTELSAT 6).** Sach, E.D.; Huettmann, H.J.; Fritsche, E. Apr 1986. NTIS, PC A19/MF A01. (ETN—86-98078; CONF-8512111—).

From International conference on spacecraft structures; Toulouse, France (3 Dec 1985).

To meet the strong frequency requirements in stowed configuration of the INTELSAT 6 solar array (2 central telescoping cylinders in sandwich design, the face sheets of which are made of aramid fiber fabric and carbon fiber fabric) analyses were performed to show the influence of fiber orientations, number of layers and stiffener rings and boundary conditions on the dynamic behavior. The investigations show that each reinforcement measure is effective only in a very limited range. To fulfill the frequency requirement with a minimum structural mass, a combination of several reinforcements is necessary.

13361 (ISAS-SP—4, pp vp) **Two dimensional analysis of high voltage solar array interfering with ionospheric plasma.** Kuninaka, H.; Kuriki, K. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

The spacecraft which flies in Low Earth Orbit being biased at high voltage is affected by undesirable interference with the ionospheric plasma. Two dimensional analysis was performed about the solar array which has 10 m span and is biased at 1 kV. For the standard ionospheric conditions the drain power assumes about 0.25% of the generated power, which is rather insignificant. On the other hand, the ion drag amounts to about 130% of the neutral particles collision drag, which represents drastic increase of the satellite drag.

13362 **(N—86-31793) Space solar cell research: Problems and potential.** Flood, D.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 13p. (NASA-TM—88833; E—3212; NAS—1.15:88833; CONF-8609127—16). NTIS HC A02/MF A01.

From SPIE's fiber LASE '86; Cambridge, MA, USA (14 Sep 1986).

The value of a passive, maintenance-free, renewable energy source was apparent in the early days of the space program, and

the silicon solar cell was pressed into service. Efficiencies of those early space solar arrays were low, and lifetimes shorter than hoped for, but within a decade significant advances had been made in both areas. Better performance was achieved through improvements in silicon single crystal material, better device designs, and a better understanding of the factors that affect the performance of a solar cell in space. Chief among the latter, particularly for the mid-to-high altitude (HEO) and geosynchronous (GEO) orbits, are the effects of the naturally occurring particulate radiation environment. Although not as broadly important to the photovoltaic community at large as increased efficiency, the topic of radiation damage is critically important to use of solar cells in space, and is a major component of the NASA research program in space photovoltaics. A brief overview of some of the opportunities and challenges for space photovoltaic applications is given, and some of the current research directed at achieving high efficiency and controlling radiation damage in space solar cells is discussed.

13363 **(N—86-32627) Potential high efficiency solar cells: Applications from space photovoltaic research.** Flood, D.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 15p. (NASA-TM—88832; E—3194; NAS—1.15:88832; CONF-861146—11). NTIS HC A02/MF A01.

From AIChE winter annual meeting; Miami, FL, USA (2 Nov 1986).

NASA involvement in photovoltaic energy conversion research development and applications spans over two decades of continuous progress. Solar cell research and development programs conducted by the Lewis Research Center's Photovoltaic Branch have produced a sound technology base not only for the space program, but for terrestrial applications as well. The fundamental goals which have guided the NASA photovoltaic program are to improve the efficiency and lifetime, and to reduce the mass and cost of photovoltaic energy conversion devices and arrays for use in space. The major efforts in the current Lewis program are on high efficiency, single crystal GaAs planar and concentrator cells, radiation hard InP cells, and superlattice solar cells. A brief historical perspective of accomplishments in high efficiency space solar cells will be given, and current work in all of the above categories will be described. The applicability of space cell research and technology to terrestrial photovoltaics will be discussed.

13364 **(PB—87-134060/XAB) Energy transfer and photochemistry in biomimetic solar conversion. Annual report, October 1985-September 1986.** Boxer, S.G. (Stanford Univ., CA (USA). Dept. of Chemistry). 30 Aug 1986. 15p. NTIS, PC A02/MF A01.

Electron transfer is being studied in several well-defined molecular systems, and new techniques for studying electron transfer are being developed. Photo-induced electron transfer lies at the heart of photosynthesis and forms the basis for the author's approach to biomimetic solar conversion. Electron donors and acceptors are covalently connected to molecular frameworks which permit variation of the distance between sites and the nature of the intervening medium. Myoglobin produced by recombinant DNA methods has a free sulfhydryl for attachment of various electron acceptors. The feasibility of attachment has been demonstrated, and the free sulfhydryl group has been moved in the sequence by site-specific mutageneis. The effects of electric fields on electron-transfer kinetics was treated theoretically. From the analysis, it is evident that the effects of electric fields on recombination kinetics in well-chosen systems offers a very useful approach to understanding important features of electron transfer.

13365 **(SERI/CP—211-3086) Proceedings of the 1987 amorphous silicon subcontractors' review meeting.** (Solar Energy Research Inst., Golden, CO (USA)). Jan 1987. Contract AC02-83CH10093. 322p. (CONF-870115—). NTIS, PC A14. File Number DE87001120.

From Amorphous silicon subcontractors' review meeting; Palo Alto, CA, USA (26 Jan 1987).

Separate abstracts were prepared for 30 papers in these proceedings. Papers deal with silicon deposition, plasma and materials characterization, alloy materials, light-induced effects, and solar cells and submodules. (LEW)

13366 **(SERI/RR—212-3064) Optical and photoconductive characteristics of CuIn/sub y/Ga/sub 1-y/Se_2 and Cu/sub x/Ag/sub 1-x/$InSe_2$.** Durrant, J. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1987. Contract AC02-83CH10093. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001138.

Optical and photoconductivity measurements were carried out to determine the composition dependence of the band gap of the solid solutions in CuIn/sub y/Ga/sub 1-y/$InSe_2$ and Cu/sub x/Ag/sub 1-x/$InSe_2$. The near-infrared absorption was measured and an exponential fit observed. The near-infrared spectral photoconductive response was also measured at 300 K and, for some samples, at 77 K. Variations in photoconductivity with temperature were also observed. The band-gap variation was estimated and bowing parameters of 0.161 and 0.305 calculated for the gallium and silver series, respectively. One or more shallow acceptor levels have been observed at a depth varying from 160 MeV for high-gallium samples to 10 MeV for high-silver samples. Thermal quenching was also observed and a donor level conjectured in high-silver samples.

13367 **(SERI/STR—211-3067) Evaluation of the graded-band-gap solar cell concept: Final subcontract report, November 1983-December 1985.** Borrego, J.M.; Ghandhi, S.K. (Rensselaer Polytechnic Inst., Troy, NY (USA); Solar Energy Research Inst., Golden, CO (USA)). Nov 1986. Contract AC02-83CH10093. 81p. NTIS, PC A05/MF A01. File Number DE87001127.

This report summarizes the results of a two-year research program to investigate the feasibility of using graded-band-gap solar cells under high illumination as an alternative to tandem solar cells. Details of the work done in the first year are briefly summarized. The bulk of this report deals with work done during the second year. This is divided into three sections, covering extension of the work on computer simulations, on the organometallic growth of active layers and the fabrication of test structures, and on the development of new diagnostic tools for work in this area. Prospects for the concept are discussed in the summary.

13368 **(SERI/STR—211-3068) Stable high-efficiency $CuInSe_2$-based polycrystalline thin-film tandem solar cells: Annual subcontract report, 16 March 1985-15 March 1986.** Birkmire, R.W.; Phillips, J.E. (Delaware Univ., Newark (USA). Inst. of Energy Conversion; Solar Energy Research Inst., Golden, CO (USA)). Nov 1986. Contract AC02-83CH10093. 71p. D. File Number DE87001128.

Progress was made in the development of CdTe and $CuInSe_2$ heterojunctions for use in a tandem solar cell configuration. An essential feature of the CdTe cell is that both contacts to the cell must be highly transparent to wavelengths beyond the CdTe band edge. A suitable contacting system has been developed using transparent conducting oxides such as ITO along with a thin layer of copper. Efficiencies for the CdTe cells have improved during the year; continued progress is anticipated. Development of the $CuInSe_2$ cell has focused on raising the efficiency of small cells (3 x3 mm^2) and transferring the technology to 1-cm^2 cells. The small cells were repeatably made with efficiencies between 10% and 11%; up to 8% was achieved with 1-cm^2 cells. It has been demonstrated that the $CuInSe_2$ composition can vary over a considerable range, at least +-1.5%, and still yield cells of high efficiency. A preliminary process design was carried out for the production of two- and four-terminal tandem cells based on CdTe and $CuInSe_2$. Key areas requiring further laboratory development were identified.

13369 **Electron-transfer reactions between pentaaquo(organo)chromium(2+) and tris(bipyridyl)ruthenium(3+) ions.** Melton, J.D.; Espenson, J.H.; Bakac, A. (Iowa State Univ., Ames). *Inorganic Chemistry;* **25**: No. 23, 4104-4108(5 Nov 1986). Contract W-7405-ENG-82.

The ruthenium complex $Ru(bpy)_3^{3+}$, generated by laser flash photolysis, reacts with a wide range of $(H_2O)_5CrR^{2+}$ complexes. The first step in the sequence is attributed to the one-electron oxidation of the organochromium cation. This step is accompanied by

formation of $Ru(bpy)_3^{2+}$. The rate constants (i-Pr > Et >> Me) correlate with the ionization potentials of the free radicals R^0. Values for para-substituted benzylchromium ions follow the Hammett correlation. The immediate product of electron transfer, CrR^{3+}, can undergo homolysis, as found for R = Et by kinetic tests and radical trapping, or in suitably constituted cases it can react by internal electron transfer, e.g., $CrCH_2OCH_3^{3+} + H_2O \rightarrow Cr^{2+} + CH_3OCH_2OH + H^+$. 33 references, 4 figures.

13370 **Gasification of wood wastes in the RENUGAS process.** Evans, R.J.; Onischak, M.; Knight, R.A.; Babu, S.P. (Institute of Gas Technology, Chicago, IL). *Urja;* **20**: No. 2, 135-146(Aug 1986).

The Institute of Gas Technology (IGT) is developing the RENUGAS pressurized fluidized-bed biomass gasification process. The process research unit (PRU), built for this purpose, is 11.5 in. ID and designed for operation at up to 1800°F and 515 psia. It is capable of handling biomass feed rates up to 2 tons per day. Adiabatic, pressurized, fluidized-bed steam and oxygen-blown biomass gasification tests were conducted in the process research unit to develop process optimization information for the production of medium-Btu gas. The test program investigated the effect on gasification performance to temperature. pressure, biomass throughput rate, steam-to-biomass ratio, type of feedstock, feedstock moisture, and fluidized-bed height. Long-duration gasification tests (up to 3 days of steady-state operation) were made to establish material and energy balances, to observe the possible breakthrough of low-concentration organic compounds, and to evaluate the mechanical performance of the system. Test results indicate that the process, which has proven to be simple to operate, can achieve carbon conversions of about 95% with thermal efficiencies of about 75% and with low oil and tar production.

13371 **Feasibility of biomass-based fuels and chemicals production in the USA.** Young, J.; Griffen, E.; Russell, J. (Pacific Northwest Labs., Richland, WA). *Biomass;* **10**: No. 1, 9-25(1986).

Under the sponsorship of the Energy Conversion and Utilization Technology (ECUT) Division of the US Department of Energy, a recent study by Pacific Northwest Laboratories estimated the fossil energy savings possible from large-scale applications of biomass conversion technologies for fuels and bulk chemicals production in the US. Using wastes, residues and surplus crops, 1% of the liquid and 16% of the gaseous fuel requirements could be replaced using bio-derived fuels. Growing biomass for the production of ethanol, methanol or SNG to replace the total US demand for liquid or gaseous fuels would require 792%, 253% or 108% more land than is currently available, respectively. For the bulk chemicals industry, 2.20 EJ (one exajoule is 10^{18} J) or 2.1 quads (one quad is 10^{15} Btu) of fossil feedstocks could be replaced by 3.70 EJ (3.51 quads) of biomass; however, the process energy requirements for biomass would exceed conventional process fuel requirements by up to 1.21 EJ (1.15 quads) due to problems such as diluted products. The study concludes that research is needed to improve biomass yields and bio-process efficiencies. 11 references.

13372 **Status of chemical vapor deposition methods for hydrogenated amorphous silicon.** Stafford, B.; Sabisky, E. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, CO 80401). pp 409-412 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Chemical vapor deposition (CVD) is an effective method for producing efficient hydrogenated amorphous silicon (a-Si:H) photovoltaic cells. The general class of chemical vapor deposition, which includes glow discharge, photo-CVD, thermal CVDE, and laser-induced CVD, is reviewed.

13373 **Photoconversion - A future energy technology option.** Seibert, M. (Photoconversion Research Branch, Solar Energy Research Institute, Golden, CO 80401). pp 106-116 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Photoconversion provides a means to produce fuels and chemicals directly from abundant resources such as water, carbon dioxide, and nitrogen in solar light-driven processes. Thus, photoconversion research could lead to the next generation of fuel- and chemical-producing solar energy conversion technologies. Given a continuation of present progress, photoconversion processes could be in a position to provide a basis for new renewable energy technology options during the next decade and a half.

13374 **Overview of biomass fast pyrolysis and catalytic upgrading to liquid fuels.** Reed, T.B.; Diebold, J.P.; Chum, H.L.; Evans, R.J.; Milne, T.A.; Scahill, J.W. (Solar Energy Research Institute, Golden, CO 80401). pp 92-105 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Biomass is a heterogeneous terpolymer network composed of cellulose, hemicellulose and lignin. When heated very rapidly it breaks down to form high yields of vapors consisting of monomers and fragments of these polymers. If these vapors are condensed they form a water soluble oil which can be used as a boiler or gas turbine fuel. However, this fuel oil is corrosive, chemically reactive and not suitable as a general transportation fuel. The authors have found that the pyrolysis vapors can be cracked using catalysts, for instance Mobil ZSM-5 zeolite, to form mostly hydrocarbon molecules which have the potential of being a high octane liquid fuel. The authors are now investigating these catalytic reactions and are seeking the optimum operating conditions on which to base the engineering of a process to produce premium quality liquid fuels and fuel additives directly from biomass in a simple low pressure one step process.

1406 Photovoltaic Power Systems

13375 **(DOE/CS/30078—T1) Navy experience with photovoltaic power systems.** Hall, M.R.; Smith, G.D. (Naval Weapons Center, China Lake, CA (USA)). Aug 1985. Contract AI01-79CS30078. 15p. (NWC-TM—5496). NTIS, PC A02/MF A01. File Number DE87004318.

The US Navy has 75 photovoltaic power systems with a total array size of 100 kilowatts. The systems include small and large cost-effective remote applications, as well as two grid-connected applications. The Navy has gained valuable experience with the purchase, maintenance, and reliability of photovoltaic power systems. Experience has shown photovoltaic modules and batteries to be very reliable, while power conditioning and voltage regulating equipment to be the least reliable components. Experience has shown that of the companies proposing designs most are capable. It is necessary for the buyer to be discerning.

13376 **(N—87-11343) Solar powered hybrid sensor module program.** Johnson, J.M.; Holmes, H.K. (Hughes Aircraft Co., Newport Beach, CA (USA)). Mar 1985. 32p. (NASA-CR—172495; NAS—1.26:172495). NTIS, PC A03/MF A01.

Geo-orbital systems of the near future will require more sophisticated electronic and electromechanical monitoring and control systems than current satellite systems with an emphasis in the design on the electronic density and autonomy of the subsystem components. Results of a project to develop, design, and implement a proof-of-concept sensor system for space applications, with hybrids forming the active subsystem components are described. The design of the solar power hybrid sensor modules is discussed. Module construction and function are described. These modules combined low power CMOS electronics, GaAs solar cells, a crystal oscillatory standard UART data formatting, and a bidirectional optical data link into a single 1.25 x 1.25 x 0.25 inch hybrid package which has no need for electrical input or output. Several modules were built and tested. Applications of such a system for future space missions are also discussed.

13377 **(SAND—86-1380C) Some applications of recent R and D experiences in the sizing of stand-alone photovoltaic power systems.** Menicucci, D.F. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 4p. (CONF-870307—5). NTIS, PC A02/MF A01. File Number DE87003156.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

Stand-alone photovoltaic (PV) power systems have become a cost-effective energy source for various applications. As the demand for stand-alone PV power systems grows, more importance is placed on improving system cost-effectiveness and reliability. Sandia National Laboratories is responding to this need through the development of detailed PV performance models which are being employed as the basis for simplified design methods. This paper outlines some of the most important conclusions from this work including the application of PVFORM, a computerized systems simulation model in optimizing a PV system configuration. Specific examples are presented and the use of the model is described with respect to determining the most cost-effective component configuration in a stand-alone PV system. Also outlined is an analysis of the expected long-term performance of a stand-alone PV system with respect to its capacity to service the load reliably.

13378 **(SAND—86-2851C) Designing photovoltaic systems.** Jones, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 22 Mar 1987. Contract AC04-76DP00789. 6p. (CONF-870307—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003502.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

Photovoltaic system design understanding has matured rapidly in the last decade. Initially the design process emphasized detailed modeling, load match, and on-site energy storage. This entire approach ended once the systems were allowed to operate interactively with the utility. Current design thinking emphasizes system energy cost in relation to utility avoided cost. This leads to a new logic that allows for much simplified design procedures. This paper reviews these procedures for the two types of grid-connected photovoltaic systems and presents a brief discussion of balance-of-system options.

13379 **High-efficiency photovoltaics: Key to widespread use of PV.** Leboeuf, C.M.; Benner, J.P. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). pp 380-383 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Salient features of high-efficiency photovoltaic devices for flat-plate and concentrator terrestrial applications, fabricated from alloys of gallium arsenide, are discussed. The rationale for investigating high-efficiency devices, including their potential for cost-effectiveness and relationship to the National Photovoltaics Program's goals, is presented. A brief description of several promising device concepts is given, together with a summary of the most recent advances in the SERI Advanced High-Efficiency Concepts Program.

13380 **Assessment criteria for photovoltaic technologies.** McConnell, R.D. (Solar Energy Research Institute, Golden, CO 80401). pp 384-387 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The identification and use of assessment criteria, such as the criteria discussed in this paper, are not meant to inhibit imagination and creativity but rather to bring consistency and objectivity to the evaluation process needed in the technical management of high-risk research. The assessment method has its limitations, since estimates and approximations are necessary to provide the information and data needed to answer the ultimate question of photovoltaic technology assessment: Will the technology be cost effective?

13381 **Experience with the application of photovoltaics devices.** Jones, G.J. (Sandia National Labs., Albuquerque, NM 87185). pp 26-40 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Photovoltaic systems have been the subject of a large research and development activity for the last decade. Hundreds of studies have addressed the question of optimal system and subsystem design. Field experiments have tested the resulting concepts and verified the reliability of the technology. As a result of these efforts, system design has reached a state of maturity in all application classes. Configurations are simple, with the photovoltaic system viewed as an electricity source. This paper reviews the evolution of system understanding to the present and provides a summary of the current design approach for each of the application types.

13382 **Future new devices for photovoltaic conversion.** Stone, J.L. (Solar Electric Research Div., Solar Energy Research Institute, 1617 Cole Boulevard, Golden, CO 80401). pp 22-25 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The level of interest in thin film research and development has increased at a rapid rate over the last few years. Considerable progress in the research lab has been very quickly translated into commercial products for near-term markets, primarily for consumer products and small power applications. Although much work remains to be done in improving the performance and reliability of these thin film devices, the future continues to look optimistic for eventual deployment of thin film power modules and arrays for energy significant utilization.

1407 Solar Thermal Power Systems

13383 **(N—86-32520) Electrical power system for the U.S. space station.** Nored, D.L.; Hallinan, G.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 12p. (NASA-TM—88856; E—3249; NAS—1.15:88856; IAF—86-37; CONF-8610195—1). NTIS HC A02/MF A01.

From 37. congress of the International Astronautical Federation; Innsbruck, Austria (4 Oct 1986).

The Space Station Electrical Power System presents many interesting challenges. It will be much larger than previous space power systems, and it must be designed for on-orbit maintenance and replacement, along with having a growth capability. The power generation, energy storage, and power management and distribution (PMAD) subsystems comprise the primary elements of the overall system. Each was analyzed by NASA Lewis Research Center and its two contractors -- Rocketdyne and TRW -- in the definition studies of the program to determine the optimum approach to minimize initial costs and life cycle costs. For the PMAD subsystem, a ring bus architecture operating at 440 V, 20 kHz, single phase, was selected. Photovoltaic and solar dynamic power generation subsystems were both studied. Major tradeoffs were made for each subsystem and for the overall system, and a hybrid system (both photovoltaic and solar dynamic) was selected.

13384 **(N—86-32521) Space station power system.** Baraona, C.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 12p. (NASA-TM—88847; E—3237; NAS—1.15:88847; CONF-8609216—1). NTIS HC A02/MF A01.

From 5. conference on photovoltaic generators in space; Noordwijk, Netherlands (30 Sep 1986).

The manned space station is the next major NASA program. It presents many challenges to the power system designers. The power system in turn is a major driver on the overall configuration. In this paper, the major requirements and guidelines that affect the station configuration and the power system are explained. The evo-

lution of the space station power system from the NASA program development-feasibility phase through the current preliminary design phase is described. Several early station concepts, both fanciful and feasible, are described and linked to the present concept. The recently completed Phase B trade study selections of photovoltaic system technologies are described in detail. A summary of the present solar dynamic and power management and distribution systems is also given for completeness.

13385 **(N—87-10960) Oxidation-resistant reflective surfaces for solar dynamic power generation in near Earth orbit.** Gulino, D.A.; Egger, R.A.; Banholzer, W.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 16p. (NASA-TM—88865; E—3268; NAS—1.15:88865; CONF-861019—22). NTIS, PC A02/MF A01.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

Reflective surfaces for space station power generation systems are required to withstand the atomic oxygen-dominated environment of near Earth orbit. Thin films of platinum and rhodium, which are corrosion resistant reflective metals, have been deposited by ion beam sputter deposition onto various substrate materials. Solar reflectances were then measured as a function of time of exposure to a RF-generated air plasma. Similarly, various protective coating materials, including MgF_2, SiO_2, Al_2O_3, and Si_3N_4, were deposited onto silver-coated substrates and then exposed to the plasma. Analysis of the films both before and after exposure by both ESCA and Auger spectroscopy was also performed. The results indicate that Pt and Rh do not suffer any loss in reflectance over the duration of the tests. Also, each of the coating materials survived the plasma environment. The ESCA and Auger analyses are discussed as well.

13386 **(SAND—86-1291C) Value/cost optimization of solar central receiver electric power plants.** Dirks, J.A.; Chiang, C.J. (Sandia National Labs., Albuquerque, NM (USA); Pacific Northwest Lab., Richland, WA (USA)). 1987. Contract AC04-76DP00789. 21p. (CONF-870307—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003509.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

This paper describes a value and cost analysis of solar central receiver power plants using molten salt external receiver technology. These plants were assumed to operate within the service area of the Southern California Edison Company. The SOLERGY computer code was used to simulate the performance of the solar plants using 1984 weather data for Barstow, California. It is shown that a value-maximizing dispatch strategy which uses thermal storage to operate the turbine during the utility's peak demand period, in preference to the non-peak demand periods, can greatly increase the value of a solar central receiver power plant with little increase in the levelized energy cost. Results are presented as functions of storage capacity, type of dispatch strategy, size of the field relative to the turbine, and turbine size.

13387 **(SAND—86-1492) Central Receiver Test Facility experiment manual.** Maxwell, C.; Holmes, J. (Technadyne Engineering Consultants, Inc., Albuquerque, NM (USA); Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 56p. NTIS, PC A04/MF A01. File Number DE87003962.

This manual provides potential users with detailed information about the Central Receiver Test Facility operated by Sandia National Laboratories for the US Department of Energy. This installation is the primary solar test facility for component and subsystem evaluations within the Department of Energy's Solar Central Receiver development program, and can also be used for thermal effects testing. Administrative procedures, facility capabilities and interfaces, and the information required from potential experimenters by site personnel are described.

13388 **(SAND—86-1588C) Feasibility and potential of a direct absorption receiver in a nitrate salt solar power system.** Tyner, C.E.; Tracey, T.R. (Sandia National Labs., Albuquerque, NM (USA). Central Receiver Technology Div.; Tracey (Thomas R.), Denver, CO (USA)). 1987. Contract AC04-76DP00789. 17p. (CONF-870307—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86015403.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

The Direct Absorption Receiver (DAR) concept was proposed in the mid 1970's as an alternative advanced receiver concept to simplify and decrease the cost of central receiver systems. Rather than flowing through tubes exposed to the concentrated solar flux, the heat-absorbing fluid (a blackened molten nitrate salt) flows in a thin film down a basically flat, vertical panel and absorbs the flux directly. Potential advantages of the DAR include a substantially simplified design, improved thermal performance, increased reliability and operating life, and decreased operating costs. High flux capability also results in decreased receiver size and capital costs. The cost savings and improved performance can result in reductions in levelized energy costs of 19% (near-term) to 28% (long-term). Perhaps more importantly in the near-term, lifetime considerations and the simplicity of design could decrease the perceived risks associated with construction of a commercial central receiver system.

13389 **(SAND—86-1733C) Energetics of extended operation of a hybrid solar total energy system.** Stine, W.B.; Heckes, A.A. (California State Polytechnic Univ., Pomona (USA). Dept. of Mechanical Engineering; Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 9p. (CONF-870307—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003037.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

The US DOE sponsored Solar Total Energy Project (STEP) at Shenandoah, Georgia, provides electricity, process steam, and cooling to the adjacent Bleyle of American knitwear facility. In the summer of 1985 a set of continuous operations were performed where the STEP plant was operated, during the daytime only, for 30 consecutive days, and continuously (24 hours per day) for a period a of 14 consecutive days. The operational mode was cogeneration energy output, with hybrid (solar/fossil) energy input. Solar energy was utilized as much as possible. This paper presents results from these experiments.

13390 **(SERI/TP—252-2964) High temperature direct contact heat exchange.** Bohn, M.S. (Solar Energy Research Inst., Golden, CO (USA)). 1 Jan 1987. Contract AC02-83CH10093. 14p. (CONF-8606160—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001132.

From 3. international workshop on solar thermal central receiver systems; Konstanz, F.R. Germany (23 Jun 1986).

This paper briefly reviews previous economic and performance analyses of direct-contact heat exchange. A detailed heat transfer analysis is then presented in general terms, and results of this analysis are compared with experimental data available in the literature and some recent experimental results from the Solar Energy research Institute on an air-molten carbonate salt system as would be used for a central receiver application.

13391 **(SERI/TP—252-3013) Experiments and analysis on the molten-salt direct-contact absorption receiver concept.** Bohn, M.S.; Wang, K.Y. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1986. Contract AC02-83CH10093. 10p. (CONF-870307—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001123.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

This paper presents results of recent experiments on the Direct Absorption Receiver (DAR) concept using molten salt as the working fluid. The DAR concept may result in a solar central receiver that costs 50% less than the current tube receiver and has significantly lower operational and maintenance costs. These experiments were aimed at determining whether the DAR concept is technically feasible and were carried out at the Advanced Compo-

nents Test Facility, Atlanta, GA. Results are based on several days of operating with solar flux ranging up to 50 W/cm² and also on a numerical model that is capable of predicting the thermal performance of the DAR salt film. Issues relating to thermal efficiency, absorber-to-salt heat transfer, and salt film stability are addressed.

13392 **(SERI/TR—252-2884) Direct absorption receiver experiments and concept feasibility.** Bohn, M.S.; Green, H.J.; Yeagle, G.; Siebarth, J.; Asbell, O.D.; Brown, C.T. (Solar Energy Research Inst., Golden, CO (USA); Georgia Inst. of Tech., Atlanta (USA). Research Inst.). Oct 1986. Contract AC02-83CH10093. 143p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87001117.

This report presents the results of recent experiments on the direct absorption receiver (DAR) concept using molten salt as the working fluid. These experiments were aimed at determining whether the DAR concept is technically feasible and were carried out at the Advanced Components Test Facility, Atlanta, Georgia. Results are based on several days of operating with solar flux ranging up to 50 W/cm² and also on a numerical model capable of predicting the thermal performance of the DAR salt film. Issues relating to thermal efficiency, absorber-to-salt heat transfer, and salt film stability are addressed.

13393 **Heat engine development for solar thermal dish-electric power plants.** Linker, K.L. (Sandia National Labs., Albuquerque, NM). pp 296-299 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC04-76DP00789.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The Department of Energy's (DOE) Solar Thermal Program has as one of its responsibilities the development and evaluation of heat engine technologies which are applicable to Distributed Receiver Systems. The primary research and development activities, for the past several years, have involved the so-called dish-electric concept in which a heat engine, solar receiver, and generator are coupled and located at the focus of a parabolic dish concentrator. Power conversion assemblies (PCA) would be deployed at the size of about 25 to 50 kWe which is consistent with concentrator development in the 11-15m diameter range. This report will outline the status of heat engine development, present test data and performance evaluations from experimental work to date, and discuss the strategy for future development efforts.

13394 **Performance of optimized solar central receiver systems as a function of receiver thermal loss per unit area.** Pitman, C.L.; Vant-Hull, L.L. (Univ. of Houston, TX). *Solar Energy;* **37**: No. 6, 457-468(1986).

Recent efforts in solar central receiver research have been directed toward high-temperature applications. Associated with high-temperature processes are greater receiver thermal losses due to thermal radiation and convection. This article examines the performance of central receiver systems having optimum heliostat fields and receiver aperture areas as a function of receiver thermal loss per unit area. The results address the problem of application optimization, where the receiver design, temperature and consequently thermal loss per unit area may vary. A reasonable range of values for the primary independent variable L (the average thermal loss per unit area of receiver aperture) and a reasonable set of design assumptions were first established. Heliostat field analysis and optimization required a detailed computational analysis. Results are discussed for tower focal heights of 150 and 180 m. Values of L ranging from 0.04 to 0.50 MW per square meter were considered, roughly corresponding to working fluid temperatures in the range of 650-1650°C. As L increases over this range, the receiver thermal efficiency and the receiver interception factor decrease. The optimal power level drops by almost half, and the cost per unit of energy produced increases by about 25% for the base case set of design assumptions. The resulting decrease in solar subsystem efficiency (relative to the defined annual input energy) from 0.57 to 0.35 is about 40% and is a significant effect. Unoptimized systems would experience an even greater degradation in cost-effectiveness.

1409 Solar Thermal Utilization

13395 **(EPRI-EM—4965) Solar hot water manual for electric utilities: Domestic hot water systems: Final report.** Ahmed, S.F.; Estoque, J. (Burt-Hill-Kosar-Rittelmann Associates, Washington, DC (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 175p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920203.

This manual is a consolidation of research quantifying the potential of solar domestic hot water (DHW) systems to satisfy electric utility load management objectives, especially peak clipping. Performance data on solar, heat pump, and utility-controlled DHW systems were collected and analyzed; computer simulations were also performed to obtain hour-by-hour demand curves during typical summer and winter days in seven geographic regions. The results show promise for solar and heat pump water heaters in all parts of the country when compared with conventional electric water heaters. Demand reduction by solar DHW systems during the peak period ranges from 12 to 78% in summer and 0 to 36% in winter, depending on geographic location. Demand reduction by heat pump water heaters during the peak period averages around 50% in both summer and winter in all locations. Load management of solar DHW systems can shift demand to evening hours, but provides only limited energy savings to homeowners.

13396 **(SAND—86-1286C) Influence of metal surfaces on coking in a reforming/methanation thermochemical transport distributed receiver solar energy system.** Weirick, L.J.; Greenholt, C.J. (Sandia National Labs., Albuquerque, NM (USA). Corrosion Div.). Sep 1986. Contract AC04-76DP00789. 16p. (CONF-870307—1). NTIS, PC A02/MF A01. File Number DE86015400.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

A number of thermochemical cycles have been proposed for energy transport. The one under investigation at Sandia National Laboratories Albuquerque involves converting a carbon dioxide/methane mixture to carbon monoxide and hydrogen during the endothermic reforming reaction, and then back again to carbon dioxide and methane during the exothermic methanation reaction. Carbon formation and deposition in either the reformer or the methanator is a serious concern. We performed simultaneous thermogravimetric and gas spectrometric analyses to measure carbon deposition rate and changing gas composition in the presence of material candidates for use in the reforming/methanation loop. We found that nickel-base superalloys such as Inconel 625 are good candidates for the high temperature endothermic reforming reactor, and stainless steels such as 316L will suffice for the low temperature exothermic methanation reactor. We also found that adding carbon dioxide to the carbon monoxide/hydrogen gas mix in an attempt to reduce carbon formation was not effective, particularly at lower temperatures for iron-base alloys. More important to the propensity to form carbon is the ratio of carbon monoxide to hydrogen. 9 figs., 1 tab.

13397 **(SERI/RR—254-3059) Passive solar in the United States: 1976-1986.** Balcomb, J.D. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1987. Contract AC02-83CH10093. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87001136.

A decade of experience in passive solar development in the United States is reviewed. More than 200,000 residential and 15,000 institutional and commercial passive solar buildings have been constructed since 1976. The evolution of the program through its peak in 1980 to the present is described. Methods of performance prediction and evaluation are discussed including analysis methods, design tools, test modules and monitored buildings. Results of the monitoring show excellent performance, generally in agreement with the analysis, for both residences and larger buildings. Passive practice is analyzed and problems are discussed. The current research program is described. Potential savings are estimated.

13398 **(SERI/STR—254-3058) A reliability and maintainability study of selected solar energy system components in the Solar in Federal Buildings Program: Final subcontract report.** Logee, T.L.; Pakkala, P.A.; Pollock, E.O.; Raymond, M.G. (Vitro Labs., Silver Spring, MD (USA); Solar Energy Research Inst., Golden, CO (USA)). Nov 1986. Contract AC02-83CH10093. 132p. NTIS, PC A07/MF A01. File Number DE87001129.

The eight Solar in Federal Buildings Program (SFBP) solar energy systems described in this report were instrumented for automated data monitoring for system reliability and performance. Solar system pumps and solar system controllers were monitored for 3 to 9 months to provide data on failures, duty cycle, and system control setpoints. There was one pump failure, which was not enough to provide failure statistics. Controller failure rates were very high; 50% failed during the monitoring program. Controller drift was not as easily determined. The other most failure-prone component was the automatic flow control valves, 20% of which failed during the monitoring period. Only 0.7% of the collector panels were damaged by wind and freezing. The F-CHART model was used to predict failure-free performance; actual performance was compared to F-CHART predictions. It was concluded that failures that are corrected quickly have no significant effect on long-term performance.

13399 **Passive space heating with a self-pumping vapor system.** Hedstrom, J.C.; Neeper, D.A. (Los Alamos National Lab., Los Alamos, NM 87545). pp 493-498 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

In this system, which should be useful for space or water heating, a refrigerant is evaporated in a solar collector and condensed within thermal storage located in the building below the collector. The vapor pressure generated in the collector periodically forces the condensed liquid upward to the location of the collector. This paper reports results of an operational test, in which this system provided passive space heating for an outdoor test cell during a winter season. The daily average energy yield and the elevation of collector temperature caused by self-pumping are reported, as well as observations on failure modes, system reliability, and suggestions for a practical configuration.

13400 **Testing of residential packaged space heating systems.** Carlisle, N.; Farrington, R.B. (Solar Energy Research Institute, Golden, CO 80401). pp 240-243 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

In this paper, the field performance of four active solar space conditioning systems, developed under the Residential Packaged Space Heating Systems Program, are reported. The objective of the program was to develop the laboratory prototype systems that draw on the results of current component research, system performance analysis and measurements, and advanced concepts developed during the last few years. The systems were monitored for one year by the National Solar Data Network (NSDN). The paper describes the systems, presents performance data, and compares the performance of these systems to others monitored by NSDN.

13401 **Computer graphic analysis of class B hourly data.** Christensen, C.; Ketner, C. (Solar Energy Research Institute, Golden, CO 80401). pp 308-313 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

Energy Maps were developed to concisely display large amounts of hourly data and are generated using computer graphics to map data into a time-of-day by time-of-year format. The advantages are that: (1) complete hourly data for several months or a year can be compactly displayed; (2) the graphic format reveals daily patterns, day-to-day variations, and seasonal trends; and (3) the same method can be used for many variable types. Energy Maps have been used to examine data from the SERI/DOE Class B Passive Solar Performance Monitoring Program. For a range of buildings in different locations, Energy Maps show distinct pattens of energy use (depending on thermostat strategies, building characteristics, and weather).

13402 **Performance monitoring to validate site specific estimates of passive solar water heaters.** Robison, D.; Martin, K. (Oregon Dept. of Energy, 625 Marion Street, Salem, OR 97310). pp 345-348 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Field monitoring of six different passive solar water heaters was recently conducted by Bonneville Power Administration. Systems tested included three each of commercial ICS and thermosyphon designs. An automated laboratory facility was developed to record energy production under varying parameters of draw amount, draw pattern and insolation. Detailed data on field performance is available. Results are compared to performance estimates derived from standard rating tests. One procedure uses results of a low-cost system performance test and computer simulation developed by the Oregon Department of Energy (ODOE). Another estimate procedure adjusts the SRCC ratings to local climatic conditions using a methodology developed by ODOE. A third estimate procedure adjusts the SRCC ratings using a methodology developed by the University of Wisconsin. Results show the performance of passive solar water heaters can be predicted with reasonable accuracy. The estimating tools are of interest to consumers, engineers and designers who would like to compare commercial products.

13403 **A generalized solar load ratio correlation for direct gain buildings.** Wray, W.O.; Best, E.D. (Los Alamos National Lab., Los Alamos, NM 87545). pp 52-57 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

A generalized solar load ratio correlation has been developed for direct gain buildings by generating relationships between the correlation parameters and two fundamental design parameters. The first design parameter is the steady state conductance of the solar aperture, U/sub c/. The second is the effective heat capacity of the solar zone, EHC. The EHC is a single parameter that may be used to characterize a variety of mass configurations and types. As such, the EHC provides a measure of the amount of heat that may be stored one day and returned to the room air on the same day, or on succeeding days, at times and rates that lead to improvements in building performance. A mathematical expression for the EHC was developed by fitting performance results from a large matrix of detailed thermal network calculations. The generalized direct gain correlation enables the designer to estimate the performance of any direct gain building given values of U/sub c/ and EHC, provided the values lie within the ranges treated in this paper. Because U/sub c/ and EHC may both be evaluated in terms of other, more detailed design characteristics, the new correlation should be very useful.

13404 **Energy signatures: A proposed new design tool.** Balcomb, J.D. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). pp 42-47 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

Energy Signatures is a proposed new technique for aiding a designer in selecting and sizing passive solar elements on a building.

Hourly heat flux profiles for each candidate design element are determined. These profiles are then matched to the hourly energy requirement of the space accounting for weather conditions, internal heat profiles of the space, and the mass characteristics of the building. Simulation analysis techniques are used to determine the Energy Signatures, the load profiles, and check the final result. Least-squares techniques are used to determine the optimum mix of strategies. Examples are given to illustrate development of the method up to the present. Future directions and possibilities are outlined.

13405 **Design tools for passive solar applications.** Balcomb, J.D. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). pp 2-7 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Examples of passive solar design tools are given, categorized as either as evaluation tools or guidance tools or guidance tools. A trend toward microcomputer-based tools is noted; however, these are usually developed for use by engineers, rather than architects. The need for more instructive tools targeted specifically to designers is emphasized.

13406 **Energy transport using natural convection boundary layers.** Anderson, R. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, CO 80401). pp 221-223 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Natural convection is one of the major modes of energy transport in passive solar buildings. There are two primary mechanisms for natural convection heat transport through an aperture between building zones: 1. bulk density differences created by temperature differences between zones, and 2. thermosyphon pumping created by natural convection boundary layers. The primary objective of the present study is to compare the characteristics of bulk density driven and boundary layer driven flow, and discuss some of the advantages associated with the use of natural convection boundary layers to transport energy in solar building applications.

13407 **State of the art of active solar cooling.** Mitchell, J.W. (Solar Energy Lab., Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI 53706). pp 59-71 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The use of solar energy to provide cooling for building has been under intensive study for many years. Many different approaches have been proposed. The technically feasible alternatives at present are absorption chillers and desiccant devices. In this paper, the progress made in solar cooling is reviewed. The developments necessary to achieve economic cooling devices are discussed.

13408 **Comments on enhancement of radiation cooling by means of reflectors.** Berdahl, P.; Martin, M. (Lawrence Berkeley Lab., CA). *Solar Energy;* 33: No. 1, 93-94(1984). Contract AC03-76SF00098.

The author responds to a recent article suggesting that the use of reflectors in radiative cooling system to achieve lower temperatures is a new idea. He argues that, while the detailed analysis is new, it is also incorrect because it is inconsistent with the second law of thermodynamics. The letter presents supporting equations. 3 references.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 13408, 13840

13409 **(SAND—86-1172C) CIRCE [Convolution of Incident Radiation with Concentrator Errors]: A computer code for the analysis of point-focus solar concentrators.** Ratzel, A.C.; Boughton, B.D.; Mancini, T.R.; Diver, R.B. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 10p. (CONF-870307—6). NTIS, PC A02/MF A01. File Number DE87002701.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

In this paper a computer simulation code called CIRCE is discussed and examples of its application to several point-focus concentrating collector geometeries are presented. CIRCE, an acronym for Convolution of Incident Radiation with Concentrator Errors, was developed from HELIOS, a large multipurpose cone optics computer code for the analysis of central solar receiver systems. CIRCE was developed with the objective of providing knowledgeable users with an easily used design tool which does not require a large investment of time to obtain results. In CIRCE, the concentrator errors are convolved with the solar intensity profile (sunshape) to produce the flux-density distribution on a specified target plane. CIRCE may be used to analyze reflectors that are spherical, parabolic, or flat in shape and are either continuous surfaces or faceted. The current version of the code is restricted to the analysis of reflector systems which have flat rectangular or circular targets. Presented in this paper are examples of the use of CIRCE for optical performance calculations for both faceted and continuous parabolic dishes. In particular, the sensitivity of the optical efficiency to concentrator errors and to sunshapes (which are a function of the solar intensity level) is investigated for circular targets centered in the concentrator focal plane. Results for a three facet concentrator are also presented and compared with those for an equivalent area continuous parabolic dish to demonstrate the capability of the code and the differences between these concentrators. In this last example, the performance degrading effects of astigmatic focusing are shown for the three facet reflector system.

13410 **(SAND—86-7041) Development of an evacuated receiver for line-focus solar thermal collectors.** Dehne, H. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.; Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 58p. NTIS, PC A04/ MF A01. File Number DE87005211.

Acurex Corporation has recently completed the design review, fabrication assembly, and testing of an evacuated receiver for its 3021 parabolic trough solar collector. The receivers were installed at Sandia National Laboratories' Distributed Receiver Test Facility for testing by Sandia. The evacuated receivers are believed to represent a significant improvement in the state of the art of receiver technology and feature simplicity, low cost, and high collection efficiency. The background of the design is discussed detailing the criteria applied to arrive at the design. Tooling used to produce the prototype receivers is discussed as well as fabrication methods and problems encountered. Future improvements are detailed. Initial bench tests have verified the performance improvements expected over nonevacuated receivers.

13411 **(SERI/TP—252-3088) Hydrodynamics and thermodynamics of solar ponds.** Zangrando, F. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1986. Contract AC02-83CH10093. 34p. (CONF-870317—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87001124.

From Solar pond science and technology: a seminar to spread in Latin America the knowledge on solar ponds; Cuernavaca, Mexico (23 Mar 1987).

The objective of this presentation is to discuss those hydrodynamical issues that affect the performance of the solar pond as an energy collector and storage system such as: mass and energy balance; formation, stability, and maintenance of the gradient layer; energy extraction from the bottom mixed layer; stability of stratified fluids to shearing flows; interface dynamics; and wall effects. Many of these topics are not fully understood and the discussion

will focus on the present state of knowledge, the best engineering correlations available at this time, and the research that is still required to resolve the relevant issues.

13412 **Results from testing immersed heat exchangers.** Farrington, R.B.; Bingham, C.E. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). pp 260-263 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

This paper discusses the results from testing four immersed heat exchangers and compares the results with previous experimental data. These heat exchangers are typically used in indirect solar energy systems between the collector subsystem and the storage subsystem. The results show that the effectiveness decreases significantly at lower temperature differences between the heat exchanger inlet and storage tank. This not only leads to higher control system turn-off differentials but may also be a major reason that measured performance is less than predicted.

13413 **Innovative point-focus concentrator projects.** Mancini, T.R. (Solar Distributed Receiver Div. 6227, Sandia National Labs., Albuquerque, NM 87185). pp 313-316 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC04-76DP00789.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

Three point-focus concentrator designs were funded in late 1984 and early 1985 through the Department of Energy (DOE) Solar Thermal Program's Innovative Concentrator Project. The purpose of the program is to develop efficient, low cost solar concentrators as sources of high temperature thermal energy and for electrical power generation. Specific performance and survivability criteria must be met by each design. In addition, the concentrators are to be modular and mass producible, economic to manufacture, operate and maintain, and have low life-cycle costs. The three contractors, Acurex Corp., Entech, Inc., and LaJet Energy Co., completed Phase I of the project in March of this year, preparing detailed concentrator designs and demonstrating the fabricability and performance of their respective optical elements. The detailed designs include the design and analysis of each of the collector subsystems; i.e. the optical elements, supports and foundations, tracking drives and controls, and the mounting assembly for the power conversion device. This paper describes the three concentrator designs as prepared during Phase I of the DOE Innovative Concentrator Project.

13414 **The design and performance predictions of the DOE small community solar experiment at Osage City, Kansas.** Rush, E.E. (Sandia National Labs., Albuquerque, NM). pp 349-352 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC04-76DP00789.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

An important thrust of the Department of Energy's Solar Thermal Technologies Program has been the dish-electric concept in which a heat engine and generator are operated at the focus of a parabolic dish. One such module, based on a 25 kWe Stirling engine achieved, in 1984, the "world's record" net solar-to-electric conversion efficiency of 29%. To gain system-level operating experience, the Department of Energy, through cost-shared cooperative agreements with industry, is sponsoring the design, construction, and operation of two 100 kWe dish-electric solar thermal power plant field experiments. The first of these will be located at Osage City, Kansas, and is currently in the final design and prototype operation phase. The solar plant, being designed by Barber-Nichols Engineering, will incorporate four power modules, each consisting of a parabolic dish concentrator by Power Kinetics, Inc., and a 25 kWe organic Rankine cycle turbine/alternator by Barber-Nichols. Included in this presentation will be a description of the system design with particular emphasis on the concentrator, receiver, and power conversion assembly; a discussion of the issues and tradeoffs involved in the design and operation of dish-electric systems; the results of module performance verification testing being conducted at Sandia National Laboratories' Distributed Receiver Test Facility in Albuquerque; and, finally, performance predictions for the 100 kWe osage City plant and for future solar energy power plants of this type.

13415 **Pathways toward a low cost evacuated collector system.** O'Gallagher, J.J.; Winston, R.; Hull, J.R.; Schertz, W.W.; Allen, J.W. (Argonne National Lab., Argonne, IL 60439). pp 284-287 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract W-31-109-ENG-38.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The goal of widespread use of solar thermal collectors will only be achieved when they are proven to be economically superior to competing energy sources. Evacuated tubular collectors appear to have the potential to achieve this goal. An advanced evacuated collector using nonimaging concentration under development at the University of Chicago and Argonne can achieve a 50% seasonal efficiency at heat delivery temperatures in excess of 170°C. The same collector has an optical efficiency so that low temperature performance is also excellent. In this advanced collector design all of the critical components are enclosed in the vacuum, and the collector has an inherently long life-time. The current cost of evacuated systems (≈$300/m/sup 2/) is too high, mainly because the volume of production has been too low to realize economies of mass production. It appears that certain design features of evacuated collectors can be changed (e.g. use of heat pipe absorbers) so as to introduce new system design and market strategy options that can reduce the balance of system cost.

1420 Heat Storage

13416 **Aquifer thermal energy storage in the United States.** Kannberg, L.D. (Pacific Northwest Lab., Richland, WA 99352). pp 522-525 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC06-76RL01830.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

The U.S. Department of Energy (DOE) has funded investigation of aquifer thermal energy storage (ATES) since 1975. The investigation scope has encompassed numerical modeling, field testing, economic analyses, and evaluation of institutional issues. Current U.S. efforts are concentrated on a high-temperature (up to 150°C) ATES field test in Minnesota. Results to date indicate that high-temperature aquifers are good candidates for seasonal energy storage in central solar heating plants and hybrid district heating systems. Findings from earlier studies suggest that aquifer systems operated at much lower temperatures (< 50°C) also may be useful and very economical in systems employing heat pumps.

15 GEOTHERMAL ENERGY

1503 Geothermal Exploration And Exploration Technology

13417 **(DOE/SF/12196—23) Preliminary design for multi-array borehole electrical geophysical method.** Green, D.J.; Ward, S.H. (Utah Univ. Research Inst., Salt Lake City (USA). Earth Sciences Lab.). Nov 1986. Contract AC03-84SF12196. 15p. (ESL—86022-TR). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002936.

This report presents the specifications for a field data acquisition system, using a multi-array borehole resistivity and induced polarization method. (ACR)

1506 Environmental Aspects And Waste Disposal

13418 **(LA—10892-PR) Water quality in the vicinity of Fenton Hill: Progress report, 1983 and 1984.** Purtymun, W.D.; Ferenbaugh, R.W.; Becker, N.M.; Williams, M.C.; Maes, M. (Los Alamos National Lab., NM (USA)). Jan 1987. 39p. NTIS, PC A03/MF A01. File Number DE87004417.

Water quality data have been collected since 1974 from established surface and groundwater stations at and in the vicinity of Fenton Hill (Hot Dry Rock Geothermal Demonstration Site) located in the Jemez Mountains. This is part of a continued program of environmental studies. There has been a slight variation in chemical quality of water from the surface and groundwater stations; however, these variations are within normal seasonal fluctuations. Water supply at the site is pumped from the aquifer in the Abiquiu Tuff. Cumulative production from 1976 through 1984 has been 41.5 x 10^6 gal. The water level in the supply well declined from 365 ft in 1976 to 379 ft in 1984.

1508 Geothermal Power Plants

13419 **(EGG-M—20686) Analysis of the heat transfer to hydrocarbon mixtures from geothermal brines using a sieve tray column.** Jacobs, H.R.; Eden, T.J.; Mines, G.L.; Demuth, O.J. (Pennsylvania State Univ., University Park (USA). Dept. of Mechanical Engineering; Idaho National Engineering Lab., Idaho Falls (USA)). 1987. Contract AS07-84ID12552. 21p. (CONF-870307—3; PSU-ME—86-P-0136). NTIS, PC A02/MF A01. File Number DE87000480.

From ASME/JSME/ISES solar energy conference; Honolulu, HI, USA (22 Mar 1987).

In order to design geothermal direct contact binary cycle power plants it is necessary to develop design tools to size the direct contactor. Of particular importance is the design of the working fluid preheater. For sieve tray columns a method is presented which has been successfully used when the working fluid is a pure fluid. It is shown here to be equally successful when applied to fluid mixtures. Further, it is shown that when changing the working fluid mixture that column internals must be changed to meet the demands of the new conditions.

13420 **Heat cycle research program.** Demuth, O.J. (EG & G Idaho, Inc., Idaho Falls). *Geo-Heat Center Quarterly Bulletin;* 8: No. 4, 13-16(Fal 1984). Contract AC07-76ID01570.

The overall objective of the Heat Cycle Research Program, which is being conducted for the Department of Energy, is to develop technology for effecting improved utilization of moderate temperature geothermal resources. Major thrusts of the effort are directed toward (1) advances in binary cycle technology, (2) development of direct-contact heat exchanger technology for use in applications with resources having high corrosion or scaling potential, and (3) special studies, including value analyses for estimating economic advantages of plant improvement concepts and studies of other energy conversion cycles. This paper presents some background information relative to the program, summarizes the progress and program results to date, briefly discusses the authors current effort, and finally outlines some plans for future tasks. 11 references.

1509 Geothermal Engineering

13421 **Interpretation of interference data from the Klamath Falls geothermal resource, Oregon.** Benson, S.M. (Lawrence Berkely Lab., CA). *Geo-Heat Center Quarterly Bulletin;* 8: No. 2, 7-11(Win 1984). Contract AC03-76SF00098.

Data from a seven-week pressure interference test conducted in the Klamath Falls, Oregon, geothermal resource have been analyzed. The data indicate that productive wells are fed by a highly permeable fracture network and that the less permeable rock matrix contribute significantly to the reservoir storage capacity. Detailed analysis of data from two wells monitored during the test is presented. Data from both of the wells yield a reservoir permeability-thickness (kh) of approximately 1.3 x 10^6 md-ft and a storativity of 6.8 x 10^{-3} ft/psi. The double porosity parameters, which are determined by the distribution of permeability and storativity between the matrix and fractures, vary by more than an order of magnitude. A sensitivity study shows that for these wells, the pressure response is not vary sensitive to the distribution of permeability and storativity between the fractures and matrix blocks. No hydrologic boundaries were detected during the test. This indicates that the fault supplying hot water to the shallow hydrothermal system does not behave according to the classic mode of either a barrier or constant potential boundary. 10 references.

17 WIND ENERGY

1701 Availability (climatology)

13422 **(PNL—6070) Using the NOABL flow model and mathematical optimization as a micrositing tool.** Wegley, H.L.; Barnard, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87004224.

This report describes the use of an improved mass-consistent model that is intended for diagnosing wind fields in complex terrain. The model was developed by merging an existing mass-consistent model, the NOABL model, with an optimization procedure. The optimization allows objective calculation of important model input parameters that previously had been supplied through guesswork; in this manner, the accuracy of the calculated winds has been greatly increased. The report covers such topics as the software structure of the model, assembling an input file, processing the model's output, and certain cautions about the model's operation. The use of the model is illustrated by a test case.

1704 Economics

REFER ALSO TO CITATION(S) 13424

1706 Wind Energy Engineering

13423 **(N—87-10531) WEST-3 wind turbine simulator development. Volume 2: Verification. Final report.** Sridhar, S. (Paragon Pacific, Inc., Torrance, CA (USA)). Jul 1985. 31p. (NASA-CR—174982; DOE/NASA—0247/2; NAS—1.26:174982; PPI-FID—300102-VOL-2). NTIS, PC A03/MF A01.

The details of a study to validate WEST-3, a new time wind turbine simulator developed by Paragib Pacific Inc., are presented in this report. For the validation, the MOD-0 wind turbine was simulated on WEST-3. The simulation results were compared with those obtained from previous MOD-0 simulations, and with test data measured during MOD-0 operations. The study was successful in achieving the major objective of proving that WEST-3 yields results which can be used to support a wind turbine development process. The blade bending moments, peak and cyclic, from the WEST-3 simulation correlated reasonably well with the available MOD-0 data. The simulation was also able to predict the resonance phenomena observed during MOD-0 operations. Also presented in the report is a description and solution of a serious numerical instability problem encountered during the study. The problem was caused by the coupling of the rotor and the power train models. The results of the study indicate that some parts of the existing WEST-3 simulation model may have to be refined for future work; specifically, the aerodynamics and procedure used to couple the rotor model with the tower and the power train models.

13424 **Variable-speed operation of wind turbines: Impact on energy capture and economics.** Hock, S.; Tu, P. (Solar Energy Research Institute, 1617 Cole Blvd., Golden, CO 80401). pp 425-428 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

When used with wind-turbine systems, variable-speed, constant-frequency (VSCF) generators appear to offer improved performance and reduced energy costs. This paper examines the impacts of variable-speed operation on the performance and cost of energy (COE) for large and medium-size wind turbines. Preliminary results indicate that for large wind turbines energy capture will be increased by as much as 15-20%, and the resulting COE will be reduced by as much as 10-15%. The results for small to medium-size wind turbines are not as impressive, indicating that the increase in energy capture is overshadowed by significantly higher costs.

13425 **Technical aspects in wind energy conversion.** Strickland, J.H.; Berg, D.E.; Touryan, K.J. (Sandia National Labs., Albuquerque, NM 87185). pp 117-133 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—). Contract AC04-76DP00789.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

This paper summarizes the technical aspects of wind energy conversion systems and, in particular, it provides a summary of aerodynamic and structural dynamic methods which have been used on vertical-axis wind turbines. Several aerodynamic methods of analysis are summarized. These methods include momentum models, vortex models, and CFD methods. Variations of these models which are discussed are the single streamtube, multiple streamtube, and double-multiple streamtube models associated with momentum theory. The free-wake and fixed-wake models associated with vortex theory are also considered. Important issues concerning rotor structural dynamics which are discussed include loads, structural properties, and resonant response of the systems.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 13460

13426 **(BNL—38874) Regional utilities seminar.** (Brookhaven National Lab., Upton, NY (USA)). Nov 1986. Contract AC02-76CH00016. 58p. (CONF-8611106—Absts.). NTIS, PC A04/MF A01; GPO Dep. File Number DE87002589.

From Brookhaven National Laboratory regional utilities seminar life extension, energy/fuels and environment; Upton, NY, USA (5 Nov 1986).

Summaries are presented of the technical sessions on life extension of plants and equipment (analytical issues, materials), energy/fuels, and environment (physics and chemistry, impacts). Abstracts of the presentations are also included. (DLC)

13427 **(CONF-870305—2) A research program to assess the impact of the electromagnetic pulse on electric power systems.** McConnell, B.W.; Barnes, P.R. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002415.

From EMC symposium and exhibition special seminar: EMP effects on power systems; Zurich, Switzerland (3 Mar 1987).

A strong electromagnetic pulse (EMP) with an electric-field component on the order of tens of kilovolts per meter is produced by a nuclear detonation in or above the atmosphere. This paper presents an overview and a summary of the results to date of a program formulated to address the research and development of technologies and systems required to assess and reduce the impact of EMP on electric power systems. The technologies and systems being considered include simulation models, methods of assessment, definition of required experiments and data, development of protective hardware, and the creation or revision of operating and control procedures. Results to date include the development of relatively simple unclassified EMP environment models, the development of methods for extending EMP coupling models to the large transmission and distribution network associated with the electric power system, and the performance of a parametric study of HEMP induced surges using an appropriate EMP environment. An experiment to investigate the effect of corona on the coupling of EMP to conductors has been defined and has been performed in an EMP simulator. Experiments to determine the response of key components to simulated EMP surges and an investigation of the impact of steep-front, short-duration impulse on a selected number of the insulation systems used in electric power systems apparatus are being performed.

13428 **(EPRI-EL—4980) Direct analysis of transient stability for large power systems: Final report.** El-Kady, M.A.; Vaahedi, E.; Tang, C.K.; Libaque, J.; Kundur, P.; Rogers, G.; Wong, D. (Ontario Hydro, Toronto (Canada). Power System Operations Div.; Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Electrical Engineering; Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 254p. Research Reports Center, Box 50490, Palo, Alto CA 94303. File Number TI87920199.

Calculations of transient stability that bypass traditional step-by-step simulation methods have proved effective on large, realistic power system models. Characterized by increased speed and information output, direct stability analysis promises benefits such as quick calculation of power system stability limits.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 13348, 13473, 13563, 13698, 13723

13429 (CONF-8511246—, pp 1-14) **Conception of environmentally compatible power plants.** Hutter, F. (Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

An overview of the presently possible application of environmentally acceptable techniques in bituminous coal-fired large power plants is given. Different power plant variants are modelled and the correlation of the reduction of environmental stress and the corresponding necessary expenditure is shown. Condensation power plants for the use in the lower middle load region are taken as a base for the overview. Toxic gases and dust in the exhaust gas, solved and solid substances in the waste water and solid wastes are taken into account as the emissions. (HGOE).

13430 (CONF-8511246—, pp 15-22) **Development, erection and testing of an environmentally acceptable bituminous coal power plant - model power plant Voelklingen.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

In the model power plant Voelklingen the Saarberg coal combination process, a combination of the fluidized-bed combustion and hot air gas turbine with a conventional steam turbine process and the combined exhaust gas-cooling air decharge system is applied. The exhaust gases are purified in a desulfurisation plant and subsequently drawn off with the cooling air without reheating through the cooling tower. The advantage of this power plant variant is the possibility of the utilisation of low-value bituminous coal, the improvement of the plant efficiency and higher environmental acceptance. The solution of the problems occured in the operation of the power plant and possible improvements in new plants are presented. (HGOE).

13431 (CONF-8511246—, pp 23-35) **Fluidized-bed fired steam generator for the heating station Luneburg-Nord of HASTRA.** Tigges, K.-D. (Deutsche Babcock Anlagen A.G., Krefeld, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about operational experiences with the prototype steam generator plant with atmospheric fluidized-bed combustion (2x7 MW/sub th/) for the production of electrical energy and district heat from low-value coal at an elevated combustion efficiency and better environmental conditions. The experimental results of the control of the exhaust gas temperature at the end of the combustion space, the formation of the fluidized bed, the coal feeding system, the deashing, the control of output, the start-up and warm-start and the coal burn out are presented. (HGOE).

13432 (CONF-8511246—, pp 36-45) **Fluidized-bed steam generator for the cogeneration plant of RWTH Aachen.** Reinartz, A.; Renz, U.; Wedel, G. von. (Technische Hochschule Aachen, Germany, F.R. Lehrstuhl fuer Waermeuebertragung und Klimatechnik). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The demonstration fluidized-bed steam generator in the plant of RWTH Aachen which can be operated either atmospheric or pressurized at the combustion side is described. The plant schemes for both modes of operations are discussed. The main aim of the experiments is to demonstrate that the change of the combustion pressure is well suited to the flexible load adaptation of fluidized-bed plants in the heating plant operation. A series of research programmes are also carried out at this steam generator. (HGOE).

13433 (CONF-8511246—, pp 46-54) **Construction and testing of an environmentally acceptable bituminous coal power plant with atmospheric fluidized-bed combustion with an output of 124 MW/sub th/.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The fuel desulfurisation by the addition of limestone and the parallel NO/sub X/ reduction were investigated in a 124 MW/sub th/ bituminous coal power plant with atmospheric fluidized-bed combustion. Particularly the combined action of the fluidized-bed with a turbine for district heat production was studied. Operational experiences with the boiler shut-down and optimization of the combustion by a better fuel distribution in the bed, the effect of ash recirculation and the stepwise installation of the air feed are presented. (HGOE).

13434 (CONF-8511246—, pp 93-101) **Optimization of the heat decoupling from large power plants with consideration of the temporary change of the electrical current and heat demand.** Rukes, B. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

Model studies for the most economic covering of the heat demand for the substitute heat supply at a bituminous coal-fired 400 MW block are described. The lacking heat has to be supplied besides by the combined steam-power generation by a heat reservoir and/or an gas- or oil-fired reserve boiler. The influences of the heat coupling on the degree of fuel utilisation, the additional expenses for the coupled heat and the specific heat generation costs for different models are given. (HGOE).

13435 (CONF-8511246—, pp 194-201) **Sewage-gas-based decentralized cogeneration system, illustrated by the example of Oldenburg sewage treatment plant.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

At the central sewage plant of the town of Oldenburg sewer gas should be used for the combined steam-power generation and the obtained heat be fed into the district heating network. The economy of the plant was determined by test runs and parallely the plant operation should be optimized and plant parts are modified. The initial aim to deliver electrical energy to a public energy supply network was given up. (HGOE).

13436 (CONF-8511246—, pp 259-267) **District heat supply from a power plant in the low temperature range.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

By using low-grade heat from a power plant heating energy could be utilized for a housing settlement in the form of district heating. Cooling water transported to the consumers in an open system by a single tube district heating pipeline or a circulation system was used as the heat transfer medium. The heat transfer medium cooled by a heat pump was utilized to supply existing heat consuming installations. The latter were adjusted to the new heating system. (HGOE).

13437 **(DOE/MC/20229—2200) Low emission combustor technology: Final report.** LeCren, R.T.; White, D.J. (Solar Turbines, Inc., San Diego, CA (USA)). Sep 1986. Contract AC21-82MC20229. 93p. NTIS, PC A05/MF A01. File Number DE87001038.

A two-stage, high-pressure gas turbine combustion system for use with coal fuels was designed, built and tested. The system employs a fuel rich primary zone with a hot refractory wall and an internal slag removal system. The molten ash is removed by aerodynamic means using a form of jet impaction. The secondary zone is operated in a fuel-lean mode and has air cooled metal walls. The rich-lean approach was chosen to minimize the conversion of organic fuel-bound nitrogen that is present in most coals. Emission signatures were determined using a number of coal-water slurries obtained from two different suppliers. Coal-water slurry properties such as ash content, loading, and particle size were varied. An evaluation of dry micronized coal combustion was also made. A dry coal feed system was developed to allow these tests in order to provide a comparison with coal-water slurry results. The accomplishments of the program include: successful demonstration of stable coal combustion without an auxiliary fuel; effective slag/ash removal from the primary zone; combustion efficiencies of 98% based on exhaust gas composition; NOx emissions below equivalent EPA limits for Centaur size gas turbines including the allowance for fuel-bound nitrogen; and successful development of a dry coal feed system. The results of the program indicated areas which need further work before scale-up to full-size Centaur engine hardware is possible. These are described. 54 figs., 8 tabs.

13438 **(EPRI-CS—4950) 1985 fossil plant water chemistry symposium: Proceedings.** Jonas, O. (ed.). (Jonas, Inc., Wilmington, DE (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 527p. (CONF-8506329—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920148.

From Fossil plant water chemistry symposium; Atlanta, GA, USA (11 Jun 1985).

A three day EPRI Symposium devoted to water chemistry, corrosion, and scale control in fossil utility steam cycles was held June 11-13, 1985 in Atlanta, Georgia. The purpose of the Symposium was to review and discuss US and foreign practices, corrosion control requirements for boilers, turbines, and other cycle components, sampling and instrumentation, and problems with cycling units. After the introductory session which included a review of cost of corrosion and scale, the Symposium was organized in five sessions: Component and Cycle Chemistry; Current US Utility Practices; Sampling, Analysis, and instrumentation; Foreign Ap-

proach and Experience; and Cycling Units. Four parallel Working Groups had one half day discussions and formulated conclusions and recommendations. All technical papers, results of Working Group discussions, and a Summary of a Questionnaire expressing experience and opinions of utility participants are included in these proceedings. Results of the Symposium will serve US utilities in improving their practices, designers to improve cycle and component design, and EPRI to better identify R and D needs. Papers have been entered individually into EDB and ERA.

13439 **(EPRI-CS—4968) Assessment of supercritical power plant performance: Final report.** Fruchtman, I. (Ebasco Services, Inc., New York (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 110p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920191.

This work discusses the performance of supercritical power plants in the US, particularly in relation to subcritical units so that better informed value-judgments can be made when considering the purchase of new power plants. Measures of performance include availability, maintainability, control, cyclic duty capability and heat rate. Data were obtained from a literature review, a special search of the NERC (North American Reliability Council) outage data base, a questionnaire to all owners/operators of supercritical units in the US and interviews with operational personnel of supercritical power plants and their utility general offices. The report summarizes these data and presents analyses of the key factors impacting performance. For completeness, a listing and brief technical description is presented of all US supercritical units in operation. It is concluded that present supercritical units in general do provide: (1) significant heat rate benefits amounting to 150 to 200 Btu/kWh compared to a subcritical unit, (2) outage rates comparable to a drum-unit after an initial learning period, (3) relatively small added maintenance costs primarily due to solid particle erosion of turbine blading and wear of steam-generator startup system valves. The majority of problems previously attributed to the manufacturer's design, to a change in operating conditions, plant misoperation, or are unrelated to supercritical pressure level. Significant objections to the supercritical cycle have been problems associated with the startup bypass system and its limited cyclic duty capability. New supercritical steam-generators are designed to overcome these difficulties and are already operating in Japan and Europe. 60 refs., 33 figs., 9 tabs.

13440 **(EPRI-EL—4983) Synchronous machine operation with cutout coils: Final report.** Brighty, W.B.; Brown, C.A.; Kelch, E.J.; Rhudy, R.G.; Snively, H.D. (Power Technologies, Inc., Schenectady, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 142p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920197.

A project was undertaken to evaluate the performance of power plant three-phase synchronous motors and generators which have suffered stator winding failures and have then been restored to temporary service by cutting out and bypassing the failed coils. Both the circulating current within a multi-circuit phase and the changes in line current as a result of coil or circuit cutouts were analyzed in terms of machine impedance parameters. Cooperative effort with two major utilities indicated, however, that precise parameter and stator winding data would often not be on file for the failed machine. Therefore, numerical results are presented in this report based on a set of per unit values of impedances which are believed to be reasonably representative of typical power station synchronous machines now in service. Calculation procedures are provided to permit quick estimates of motor or generator current and temperature when the machine is operating with coils or complete circuits cut out. Examples are included. Recommendations are given for improving thermal or mechanical performance.

13441 **(IEA/ICEAS—E9) Conversion from oil to coal firing: Will it pay?.** Verbeek, L. (International Energy Agency Coal Research, London (UK)). Sep 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE87900471.

In recent years, high oil prices encouraged the conversion of some oil-fired stations to coal firing. This report reviews the experiences, lists the kinds of conversion tests necessary and reviews the economic attractiveness of different oil and coal prices. The conversion of a power station will include modifications to the boiler and additional equipment. Heat transfer surface arrangements and furnace dimensions are the most critical characteristics in which oil-(or gas-) and coal-designed boilers differ. These will require major and costly modifications to avoid derating. Oil-fired boilers that are already suitable for coal firing (originally coal-designed, converted to oil) have a definite advantage over strictly oil-designed boilers, in that they require only minor modifications. Data on the costs of conversion of oil-fired stations have been collected and generalized to a form suitable for economic analysis. Investment costs (excluding FGD) for originally oil-designed power stations are typically in the order of 300 to 450 US$/kWe (1983) and from 150 to 300 US$/kWe for reconversions of coal-designed units. At the present oil-coal price differential of about 2.3 US$/GJ, a high load factor (40% or more) is required for converting strictly oil-designed power stations to coal if a payback time of five years is to be met. If a FGD unit has to be installed, conversion is only cost-effective when the station is operated at base load after conversion. Restricting the extent of the furnace and heat transfer surface modification, and accepting the subsequent boiler derating for firing coal, does not have an economic advantage over a major conversion (more expensive) with a negligible derating. Reconversions of coal-designed stations exhibit appreciably better economics and are consequently the first conversion targets. 15 refs., 14 figs., 7 tabs.

13442 **(IEA/ICEAS—E10) Power generation from coal: What does it cost?.** Verbeek, L.; Gregory, R.W. (International Energy Agency Coal Research, London (UK)). 1986. 48p. NTIS (US Sales Only)03/MF A01. File Number TI87900470.

This report summarizes the economics and the costs of electricity generated in conventional pulverized coal fired plants. Two major issues are addressed: The costs of electricity from unit sizes of 200 to 800 MWe; and the economic potential of advanced supercritical steam conditions. Generic power plant investment costs were derived to investigate the effects of unit sizing, flue gas desulphurization and supercritical steam conditions. The data were obtained from a number of IEA Coal Research member countries. The investment and operating costs were derived from recent estimates and actual construction cost experience. The efficiencies were based on commercial boiler and steam turbine design and experience. The data have been put on a comparable basis as far as possible by distinguishing the component costs, but even then showed a range of approximately 35%. The range is caused by such factors as coal quality, design philosophy, labor efficiency and equipment costs. It was determined that the cost of electricity from an average 500 MWe plant (subcritical) could range from 38.4 mils/kWh with no stack gas clean-up to 44.5 for a power plant firing 4% sulphur coal with flue gas cleanup. Table 1 summarizes the range of costs. The efficiency of pulverized coal power plants may be improved by further increasing the steam conditions beyond those of the presently operating supercritical plants. Both Japan and the US are involved in similar three step programs to develop advanced double reheat supercritical power plants. Investment costs are expected to be higher than for the conventional subcritical technology; approximately 11% for plants in the first development stage with unit sizes of 700 to 800 MWe. 39 refs., 10 figs., 19 tabs.

13443 (ISAS-SP—4, pp vp) **Operating characteristics in cooling underground power cables using up sloped long heat pipes in conduit.** Oka, K.; Tsuchihashi, H.; Nishimura, Y.; Mohtai, T.; Mochizuki, M.; Mashiko, K.; Yamanouchi, H. (Fujikura Ltd., Sakura, Japan). 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

Long heat pipes for cooling electric power cables in conduit are required to operate not only in the down slope but also in the up slope. Stable operation of the heat pipe is attained by separating the vapor flow path and the liquid flow path completely, and returning the working fluid condensed by the radiator to the evaporation section end by utilizing a difference in the pressure head. An evaporating section consisting of corrugated metallic pipes and a carbon fiber wicks were employed for liquid film evaporation and

holding liquid uniformly along an axial length of the pipe. Long heat pipes with a length of 100 m, outside diameter 70 mm, and up slope 1/100 were made and tested. They operated in the normal heat pipe mode, carrying 9kW. Further the heat pipes were laid in some cable conduits providing adequate cooling effect.

13444 **(NP—7751249) Dynamic behaviour of multiple bearing turbine rotors with a cracked shaft. Final report.** Grabowski, B.; Mahrenholtz, O.; Poeppel, R. (Hannover Univ. (Germany, F.R.). Inst. fuer Mechanik). 1986. 46p. (In German). NTIS (US Sales Only), MF A01. File Number DE87751249.

The comparison in this report between measurements and calculations shows that it is possible, in principle, to calculate the vibrations produced by a crack. At the same time, it shows the problems which exist in modelling the system of rotor and bearings. The crack model developed can be used. The measurements confirm earlier theoretical results that a crack in the speed range in which the running speed of many turbines lies can cause a clear change in shaft vibration. The crack excites vibrations at the frequency of rotation and at double this frequency. Both can be used to detect cracks. One should also take into account the change of phase detecting cracks, as depending on the angular position of the crack, the original amplitude of vibration can increase or decrease because of out-of-balance with increasing depth of cracks.

13445 **(PB—87-117073/XAB) Health-hazard evaluation report HETA 85-041-1709, City of Columbus Refuse-derived Fuel Power Plant, Columbus, Ohio.** Ahrenholz, S.H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 62p. (HETA—85-041-1709). NTIS, PC A04/MF A01.

Potential for heat stress along with exposure to chemical contaminants and airborne microbial pollutants was investigated at the City refuse-derived-fuel powerplant. Health hazards existed to lead and silica exposures for workers involved in handling ash. Low levels of exposure to chromium, chromium-VI, cadmium, and nickel were noted. Excessive heat stress occurred during the maintenance activities in hot areas of the facility. Airborne microbial contamination levels in the refuse-handling areas indicate that exposure hazards exist by both the inhalation and ingestion routes. Human pathogens may be present in the microbial pollutants. The author recommends that employee exposure to lead be reduced through the use of engineering controls. Eating, drinking, and carrying or use of tobacco products or cosmetics in the power plant and refuse handling areas should be prohibited. Recommended methods for controlling heat stress were given.

13446 **(SAND—86-7044) Automatic generation control simulation user's guide.** (Power Math Associates, Inc., Del Mar, CA (USA)). Dec 1986. 125p. NTIS, PC A06/MF A01. File Number DE87004781.

This manual provides essential information for operating the computer program, "Automatic Generation Control Simulation," a program designed to provide a convenient mechanism for studying the time domain behavior of a power system that consists of several interconnected areas, each containing multiple generating stations. The simulation consists of dynamic models of the power system generating stations, loads, and control centers. These models consist of differential equations that must be integrated to determine the behavior of the interconnected system and the effectiveness of the control centers in regulating frequency and interarea power flows. The structure of the computer code is presented briefly, and the models used in the simulation are described. The data required for each model are noted, and typical values of these data are given.

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REFER ALSO TO CITATION(S) 13020, 13026, 13086, 13087, 13088, 13089, 13090, 13091, 13092, 13093, 13094, 13095, 13096, 13097, 13098, 13099, 13100, 13101, 13102, 13103, 13105, 14015, 14219, 14231, 14251, 14278

13447 (CONF-8511246—, pp 118-125) **Development and erection of a large plant for the SO/sub 2/ and NO/sub x/ removal according to the Walther process.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

According to the modified Walther process for the exhaust gas desulfurisation the sulfur and nitrogen oxides contained in the exhaust gas are converted to a directly utilisable final product, the fertilizer sulfate and nitrate of ammonia by using ammonia and ozone. The essential modifications compared with the common combined exhaust gas purification are the alteration of the exhaust gas suction arrangement, the completion of the fresh air heating by the air preheating by vapor and the incorporation of the consisting ammonia unloading and storage under pressure to the ammonia work-up and storage. (HGOE).

13448 (CONF-8511246—, pp 132-139) **Development of a waste gas purification system (ARS) consisting of a desulfurization plant and a plant to reduce nitrogen oxides.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about improvements of the desulfurisation according to the sphere recirculation system and the denitrification by catalysts consisting of ceramic spheres, a wash-coat and an active substance, for the application in power plants and heating stations of middle and small size in the range of 5-200 MW/sub el/. Ammonia was replaced by a reduction gas which was obtained by the partial gasification. Following parameters were studied until now: catalyst activity, catalyst activation and the preparation of the optimal wash-coat. (HGOE).

13449 **(DOE/PC/91021—T1) Flue gas cleanup technology utilizing energetic electrons: Technical progress report Number 2 for the period August 6, 1986-November 5, 1986.** Davis, R.H.; Finney, W.C. (ed.). (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1986. Contract AC22-86PC91021. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004128.

Contract work on several new flue gas clean up technologies utilizing energetic electrons proceeded on schedule during the second quarter. Progress on the optimization of the electron beam precharger, Task A of the two tasks, included work on precharger design, an upgrade of the E-beam, source and the ordering of a collector having a new design in preparation for the next series of optimization experiments.

13450 **(EPRI-CS—4918-Vol.3) Proceedings: Sixth symposium on the transfer and utilization of particulate control technology: Volume 3.** (Radian Corp., Research Triangle Park, NC (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 408p. (CONF-860213—Vol.3). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920155.

From 6. symposium on the transfer and utilization of particulate control technology; New Orleans, LA, USA (25 Feb 1986).

These Proceedings document the Sixth Symposium on the Transfer and Utilization of Particulate Control Technology, held February 25 through 28, 1986, in New Orleans, Louisiana. The Symposium was sponsored by the US EPA's Air and Energy Engineering Research Laboratory in Research Triangle Park, North Carolina, and EPRI's Coal Combustion Systems Division, in Palo

Alto, California. The objectives of the Symposium were to provide an opportunity for the exchange of knowledge and to stimulate new ideas in the field of particulate control research with the goal of extending the technology and aiding its diffusion among designers, users, and educators. Fabric filters and electrostatic precipitators were the major topics, but novel concepts and advanced technologies were also explored. Topics discussed in each day's sessions are listed below: Volume 1 of the Proceedings contains 26 papers presented in the Scrubbers, Opacity/Measurements, Advanced Energy Applications I and II, and Integrated Control Processes I and II Sessions. Volume 2 of the Proceedings contains 35 papers on electrostatic precipitator technology presented in the Hot-Side Precipitator, Performance Enhancement I and II, Performance Estimating (Modeling), Advanced Technology, Fundamentals I and II, Control and Energy Consumption, and Design Considerations Sessions. Volume 3 of the Proceedings contains 23 papers presented in the FF: Advanced Concepts I and II, FF: Practical Considerations, FF: Pilot-Scale Studies, Operation and Maintenance, and Fugitive Emissions Sessions. Seven papers presented at the Symposium (Nos. 3, 37, 41, 50, 51, 55, and 76 in the Symposium program) were not submitted for publication in the Proceedings. Papers have been entered individually into EDB and ERA.

13451 **(PB—87-100574/XAB) Analysis of utility control strategies using the LIMB (limestone injection multistage burner) technology. Final report, May 1985-July 1986.** Emmel, T.E.; Laseke, B.A. (Radian Corp., Research Triangle Park, NC (USA)). Sep 1986. 49p. (RAD—86-203-023-28-05). NTIS, PC A03/MF A01.

The report gives results of an evaluation of the impact of proposed acid rain legislation on the potential application of limestone injection multistage burner (LIMB) technology incorporating recent research and development findings. Several regulatory strategies and emission-reduction targets were developed. For each regulatory strategy developed, the control technology mix of LIMB, flue-gas desulfurization (FGD), and coal switching required to achieve the selected emission reduction level was determined. Next, the maximum number of boilers to which LIMB technology could be applied was determined by examining technical and regulatory constraints and emission reduction targets. The cost effectiveness of each regulatory case and control technology mix was estimated to evaluate the cost of each control technology mix. The study found that proposed acid rain legislation which mandates the retrofit of high efficiency control technologies such as FGD or which requires national SO_2/NOx reduction levels greater than 10 million tons per year would significantly reduce the application of LIMB.

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REFER ALSO TO CITATION(S) 13443

13452 **(EPRI-EL—4744) Conductor fatigue life research: Eolian vibration of transmission lines: Final report.** Ramey, G.E. (Auburn Univ., AL (USA). Engineering Experiment Station; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 470p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920200.

Wind-induced vibration can cause premature failure of transmission lines through conductor fatigue. This research identifies design considerations to reduce this effect. It also suggests methods to treat minimally damaged conductors so that the transmission line can achieve its full design life without the need for expensive splicing or reconductoring.

13453 **(EPRI-EL—4863) Power system planning and operations: Voltage-volt-ampere-reactive (VAR) projects: Seminar proceedings.** (Power Technologies, Inc., Schenectady, NY (USA); Scientific Systems, Inc., Cambridge, MA (USA); ESCA Corp., Bellevue, WA (USA); Carlsen and Fink Associates, Inc., Fairfax, VA (USA)). Oct 1986. 60p. (CONF-8510398—Summ.). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920120.

From Seminar on power system planning and operations: voltage-volt-ampere-reactive (VAR) projects; Philadelphia, PA, USA (8 Oct 1985).

In recent years, utilities have placed new emphasis on improving their voltage - VAR planning, operation, and control practices. During this seminar, utility engineers had an opportunity to review five EPRI projects that have produced procedures and computer programs to assist in voltage - VAR management.

13454 **(EPRI-EL—4979) Compact distribution substation design: Feasibility study: Final report.** Laskowski, L.M.; LaForest, J. (Ebasco Services, Inc., New York (USA); General Electric Co., Schenectady, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 173p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920198.

Accelerated escalation in the price of land costs combined with its unavailability in many urban areas has dictated the need to evaluate the techniques and equipment used in the design of distribution substations to improve the efficiency of land use for utility substations. Evaluations have been made of the state-of-the-art power technology, utilities and manufacturers surveys, substation equipment layouts, potential for further reducing equipment sizes, areas for research and development, and costs which may lead to significant contributions in reducing station size. This report presents the results of the evaluations made. It provides basic background information about existing methodologies used by utilities, potential problems and limitations which must be dealt with by utilities during the development of substation equipment layouts for installation at sites with insufficient land space.

13455 **(EPRI-EL—4981) Methods for mitigating corrosion of copper concentric neutral wires in conduit: Final report.** Hanck, J.A.; Nekoksa, G. (Pacific Gas and Electric Co., San Ramon, CA (USA). Dept. of Engineering Research; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 98p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920201.

Corrosion of CN wires is accelerated by differential aeration/concentration effects when ground water with mud and debris fills the conduit. Data also show that the corrosion process is accelerated by the galvanic action between the tin alloy coating and the copper substrate. Two corrosion control methods were found effective in controlling corrosion of CN wires. Sealing the ends of conduits and application of inhibitors on the cable, or into the conduit, would provide effective corrosion control. The inhibitor application is simple and effective for CN cable replacements, but difficult and costly for existing CN cables in conduits. To eliminate the galvanic effects between the tin alloy coating and copper wires, only bare copper CN wires should be used.

13456 **(EPRI-EL/EA—4858-Vol.2) Polychlorinated dibenzofurans (PCDF) and polychlorinated dibenzo-p-dioxins (PCDD) in utility transformers and capacitors: Volume 2, Final report.** Gordon, S.M.; Miller, M. (IIT Research Inst., Chicago, IL (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920232.

Many health effects originally attributed to PCBs appear to result from their pyrolysis and combustion by-products, PCDF and PCDD. This study developed improved techniques for characterizing these products and showed that PCDF and PCDD do not form during catastrophic arcing failure in transformers and capacitors. This volume describes analytical techniques.

13457 **(PNL-SA—14217) Electric energy systems: Trends and research and development needs for the 1990s.** Hurwitch, J.W.; Scheer, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1987. Contract AC06-76RL01830. 118p. (CONF-8510399—Summ.). NTIS, PC A06/MF A01. File Number DE87004560.

From U.S. Department of Energy electric energy systems planning workshop: trends and research and development needs for the 1990s; Seattle, WA, USA (23 Oct 1985).

A workshop was held to identify technological trends and research and development needs expected to affect the electric utility industry over the next 25 years. This document describes the workshop process, presents the results, and provides an analysis of

what these initial results might indicate in terms of future research needs for electric utilities. Goal of the workshop was to develop a list of priority R and D needs in electric energy storage, transmission, and distribution.

13458 **Performance summary of the Brookhaven superconducting power transmission system.** Forsyth, E.B.; Thomas, R.A. (Brookhaven National Lab., Upton, NY, USA). *Cryogenics;* 26: No. 11, 599-614(Nov 1986).

Following a study in 1971 at Brookhaven National Laboratory it was concluded that an optimal design for a superconducting power transmission system would utilize niobium-tin superconductor in flexible cables cooled by supercritical helium. A 1000 MVA prototype was constructed and operated from 1982 until the present. The operating performance of the cables, cable enclosure and terminations is summarized over a wide range of operating conditions. The results confirm the technical feasibility of this technology to move large blocks of electric power over long distances.

21 NUCLEAR POWER PLANTS

13459 **(CIN-AI—003) Nuclear power plants.** (Centro de Informacoes Nucleares, Rio de Janeiro (Brazil)). 1985. 93p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. File Number DE86780496.

Data concerning the existing nuclear power plants in the world are presented. The data was retrieved from the SIEN (Nuclear and Energetic Information System) data bank. The information is organized in table forms as follows: nuclear plants, its status and type; installed nuclear power plants by country; nuclear power plants under construction by country; planned nuclear power plants by country; cancelled nuclear power plants by country; shut-down nuclear power plants by country.

13460 **(DOE/NE—0079) Energy Economic Data Base Program (EEDB-VIII): Phase VIII update (1986) report.** (United Engineers and Constructors, Inc., Philadelphia, PA (USA); Oak Ridge National Lab., TN (USA)). Dec 1986. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87004572.

The objective of the Energy Economic Data Base (EEDB) Program is to provide current, representative and consistent power plant technical and cost information to the US Department of Energy (DOE). These data are useful for program planning by the Office of the Assistant Secretary for Nuclear Energy, because they are representative of current US power plant construction cost experience and are developed on a consistent, organized basis.

13461 **(DOE/S—0051) Review of the proposed Strategic National Plan for Civilian Nuclear Reactor Development: Volume 1.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Oct 1986. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87002724.

On August 9, 1985, the Secretary of Energy requested that the Chairman of the Energy Research Advisory Board establish an ad-hoc Panel to review a draft "Strategic National Plan for Civilian Nuclear Reactor Development." The resulting report, approved by the Board, contains suggestions for improving the draft plan and also contains major recommendations for alleviating the several institutional barriers that appear to preclude the construction of any new nuclear power plants in this country.

13462 **Fiscal year 1987 Department of Energy Authorization (Nuclear Fission R & D). Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress Second Session, February 27; March 6, 1986, Volume VI.** Washington, DC; Government Printing Office (1986). 572p.

Volume VI of the hearing record covers two days of testimony on the DOE basic research budget, of which over half will go in roughly equal amounts to fission and fusion research. Chairman Lloyd noted that basic research and defense programs under DOE have grown under the Reagan administration at a time when the civilian nuclear budget has suffered a nearly 70% decline. Principal witnesses were James Vaughan, Jr. of DOE, representatives of the national laboratories and NASA, the nuclear industry, and defense programs. Witnesses argued that cutting the civilian nuclear programs would be counterproductive. An appendix with additional questions and responses submitted for the record follows the testimony of the 14 principal witnesses.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 13494, 13525, 13529, 13533, 13540, 13543, 13545, 13546, 13547

13463 **(EIR—556) Validation of the code ETOBOX/BOXER for UO2 LWR lattices based on the experiments TRX,BAPL-U02 and other critical experiments.** Paratte, J.M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jul 1985. 39p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780500.

The EIR codes system for LWR arrays is based on cross sections taken out of ENDF/B-4 and ENDF/B-5 by the code ETOBOX. The calculation method for the arrays (code BOXER) and the cross sections as well were applied to the CSWG benchmark experiments TRX-1 to 4 and BAPL-UO_2-1 to 3. The results are compared to the measured values and to some calculations of other institutions as well. This demonstrates that the deviations of the parameters calculated by BOXER are typical for the cross sections used. A large number of critical experiments were calculated using the measured material bucklings in order to bring to light possible trends in the calculation of the multiplication factor k/sub eff/. First it came out that the error bounds of B/sub m/^{2} evaluated in the measurements are often optimistic. Two-dimensional calculations improved the results of the cell calculations. With a mean scattering of 4 to 5 mk in the normal arrays, the multiplication factors calculated by BOXER are satisfactory. However, one has to take into account a slight trend of k/sub eff/ to grow with the moderator to fuel ratio and the enrichment.

13464 **(EPRI-NP—4222-Vol.4) Compilation of corrosion data on the CAN-DECON process: Volume 4, General, Galvanic, Crevice, pitting, and stress corrosion data from PWR tests and applications: Final report.** Smee, J.L.; Turner, V.C. (London Nuclear Ltd., Niagara Falls, Ontario (Canada); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 216p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920216.

There exists a large data base on the compatibility of the CAN-DECON PWR dilute chemical decontamination process with materials of construction of pressurized water reactors. This information is summarized in this report by test program. The studies have shown that under normal operating conditions the CAN-DECON PWR dilute chemical decontamination process has no detrimental effect on the materials of construction used in nuclear power reactors.

13465 **(IS—4910) An evaluation of the effects of design details on the capacity of LWR steel containment buildings: Final report.** Greimann, L.; Fanous, F.; Rogers, J.; Bluhm, D. (Ames Lab., IA (USA)). Jan 1987. Contract W-7405-ENG-82. 89p. NTIS, PC A05/MF A01; GPO Dep. File Number DE87004548.

As part of their work with severe accident loadings, the Containment Integrity Division at Sandia National Laboratories has been conducting a program to evaluate the performance of containment buildings with internal pressure. After testing and analyzing a 1:8-scale steel containment model, Sandia recommended a strain failure criterion for steel containments which states that rupture will occur when the membrane strain reaches the ultimate strain. This criterion is applied to strains calculated with a shell theory which includes material and geometric nonlinearities and is applied to the actual containment. In this work, drawings from nine steel containments were studied and several significant strain concentration regions were identified and classified as: eccentricities in stiffener patterns around penetrations, eccentricities in the shell middle

surface, flat plate covers used on spare penetrations, containment base connection details, and ellipsoidal and torispherical heads and covers. As an example of a stiffener eccentricity, the 1:8-scale model was analyzed using the shell finite element in ANSYS. The results agreed well with the analytical results and some of the experimental results presented by Sandia. Examples of each of the other classifications were analyzed by finite element and/or simplified equations. In the case of middle surface eccentricities, the strains are self-limiting. Even though flat plates have primary bending strains, they are typically designed so as not to control. Bolts in the base connection have primary strains and may control. In conclusion, the Sandia strain criterion is appropriate for predicting the rupture of steel containments.

13466 **(NUREG/CR—3412-Vol.2) Containment Integrity Program: Progress report, April 1983 to December 1984.** Blejwas, T.E.; Horschel, D.S. (Sandia National Labs., Albuquerque, NM (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering Safety). Dec 1986. Contract AC04-76DP00789. 58p. (SAND—83-1482-Vol.2). NTIS, PC A04/MF A01 - GPO. File Number TI87004462.

This report contains a description of work performed between April 1983 and December 1984 under the Containment Integrity Program. The program is one of three at Sandia National Laboratories in the general area of containment integrity. The overall objective of the three programs is the qualification of methods for reliably predicting the capability of containment structures for light water reactor nuclear power plants to function under loadings caused by severe accidents and extreme environments. In the subject program, models of entire containments are tested for loadings beyond the design basis. Experiments completed during the reporting period include a series of internal-pressure tests of 1/32 and 1/8 size models of hybrid steel containments. Comparisons with pretest analyses are described.

13467 **(NUREG/CR—4544) Reactor coolant pump seal related instrumentation and operator response: An evaluation of adequacy to anticipate potential seal failures.** Luckas, W.J. Jr.; Ruger, C.J.; Tingle, A.G.; Kittmer, C.; Metcalfe, R. (Brookhaven National Lab., Upton, NY (USA); Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Review and Oversight). Dec 1986. Contract AC02-76CH00016. 198p. (BNL-NUREG—51964). NTIS, PC A09/MF A01 - GPO. File Number TI87004367.

This report provides an evaluation of the adequacy of reactor coolant pump (RCP) seal related instrumentation and associated operator responses to anticipate potential seal failure. Information was obtained directly from RCP manufacturers and nuclear steam supply system vendors and indirectly through analysis of failure data. The concept of a seal failure criterion is presented and explained as a diagnostic approach to the detection of incipient seal failure. Recommendations are provided for instrumentation, operator response-procedures and automatic actions.

13468 **(EPRI-NP—4574-CCM-Pt.2-Ch.7-Vol.2) ARMP-02 documentation: Part 2, Chapter 7, MICBURN-E computer code manual: Volume 2, User's manual.** Jones, D.B. (Levy (S.), Inc., Campbell, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 72p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920229.

MICBURN-E is a multigroup pin cell lattice physics computer code designed for the burnup analysis of light water reactor fuel rods. It was specifically developed to handle fuel rods containing an initially homogeneous mixture of fuel (UO_2) and burnable absorber (Gd_2O_3) compositions. MICBURN-E features a fine mesh geometry model which makes it particularly suitable for the analysis of fuel rods which burn according to the phenomenon for "onion-skin" depletion effects. MICBURN-E employs integral transport theory based upon the method of collision probabilities to calculate neutron flux distributions and eigenvalues for cylindrical geometries. The primary application of MICBURN-E is to generate a burnable absorber data file containing effective microscopic absorption cross sections as a function of burnup for a pseudo nuclide. This file is then supplied as input to various assembly lattice physics codes including CPM-2, EPRI-CPM and CASM0-1. MICBURN-E is written entirely in FORTRAN and is supplied with a Nuclear Data Library which contains basic microscopic cross sections and burnup parameters for several nuclides.

13469 **(EPRI-NP—4574-CCM-Pt.2-Ch.7-Vol.3) ARMP-02 documentation: Part 2, Chapter 7, MICBURN-E computer code manual: Volume 3, Programmer's manual.** Jones, D.B. (Levy (S.), Inc., Campbell, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 189p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920230.

MICBURN-E is a multigroup pin cell lattice physics computer code designed for the burnup analysis of light water reactor fuel rods. It was specifically developed to handle fuel rods containing an initially homogeneous mixture of fuel (UO_2) and burnable absorber (Gd_2O_3) compositions. MICBURN-E features a fine mesh geometry model which makes it particularly suitable for the analysis of fuel rods which burn according to the phenomenon for "onion-skin" depletion effects. MICBURN-E employs integral transport theory based upon the method of collision probabilities to calculate neutron flux distributions and eigenvalues for cylindrical geometries. The primary application of MICBURN-E is to generate a burnable absorber data file containing effective microscopic absorption cross sections as a function of burnup for a pseudo nuclide. This file is then supplied as input to various assembly lattice physics codes including CPM-2, EPRI-CPM and CASMO-1. MICBURN-E is written entirely in FORTRAN and is supplied with a Nuclear Data Library which contains basic microscopic cross sections and burnup parameters for several nuclides.

13470 **(EPRI-NP—4574-CCM-Pt.2-Ch.12-Vol.1) ARMP-02 documentation: Part 2, Chapter 12: NORGE-B2 computer code manual: Volume 1, Theory and numerics manual.** Jones, D.B.; Anderson, M.J. (Levy (S.), Inc., Campbell, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 48p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920214.

NORGE-B2 is a computer code which provides linkage between the assembly lattice physics codes CPM-2, EPRI-CPM and CASMO-1 and the nodal simulation code SIMULATE-E. NORGE-B2 produces card image data files for hot and cold SIMULATE-E models. These cards contain cross-sectional data tabulated as functions of several operational parameters. The important parameters include exposure, moderator densities, control rod presence and power (Doppler). NORGE-B2 is run for each assembly fuel type in the SIMULATE-E model. It also generates card images containing kinetics data for the SIMTRAN-E computer which links these same assembly lattice physics codes to the RETRAN code. NORGE-B2 is written entirely in FORTRAN.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 13463, 13464, 13465, 13466, 13467, 13468, 13469, 13494, 13519, 13522, 13527, 13530, 13531, 13532, 13533, 13543, 13544, 13545, 13551

13471 **(AD-A—174237/8/XAB) Validation of the modular modeling system for use in accident analysis at a small-scale reactor plant. Master's thesis.** Doty, C.V. (Pennsylvania State Univ., University Park (USA). Coll. of Engineering). Dec 1986. 145p. NTIS, PC A07/MF A01.

The Modular Modeling System (MMS) was developed for the study of the thermal hydraulic performance of pressurized-water-reactor plants at steady state and during some slowly varying transients. To determine the limits of transient severity this code can endure, two experiments conducted at the Loss of Fluid Test (LOFT) facility were simulated using the IBM/CMS computer. These experiments are a small-break loss-of-coolant accident (Experiment L3-5) and an excessive steam-generator load increase (Experiment L6-3). In the case of the former, the Modular Modeling System failed to accurately predict the performance of the LOFT

facility. The MMS was, however, successful in predicting the significant thermal-hydraulic parameters of Experiment L6-3. The MMS predictions of the LOFT facility's performance during this experiment were more accurate than those of the more-sophisticated RETRAN code. This success validates the MMS' ability to predict the performance of nuclear power plants that are scaled much smaller than central station plants.

13472 **(BNL-NUREG—39056) Recent experimental and analytical results of BNL direct containment heating programs.** Ginsberg, T.; Tutu, N.K. (Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1986. Contract AC02-76CH00016. 12p. (CONF-8610135—42). NTIS, PC A02/MF A01 - GPO. File Number TI87004178.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

The direct containment heating (DCH) scenario involves high-pressure ejection of molten core material from the reactor vessel into the region beneath the vessel and into various subcompartments of the containment building. The stored energy in the melt consists of the sensible energy of melt and the chemical reaction energy of the various components assuming that they can react with either the oxygen or the steam within containment. The metallic phase may first react with steam, if local conditions permit, and thereby produce hydrogen. The hydrogen may then burn at some later time at a different location. In order to predict the containment response, one must follow the melt through the various subcompartments of the containment building, while computing the integrated release of energy from the melt to the containment atmosphere and the quantity of hydrogen produced during the time period that the melt is suspended. The BNL research program in the area of direct containment heating is directed towards the development of a methodology to predict the hydrodynamic, chemical and thermal interactions which could take place in three regions of PWR containment buildings: the reactor cavity, the intermediate compartments (e.g., steam generator room) and the containment dome. Separate effects, scaled experiments are performed related to selected aspects of the DCH problem, and analytical models are developed to characterize the relevant phenomena.

13473 **(DOE/NE—0090) Technical reference book for the Energy Economic Data Base Program (EEDB).** (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Dec 1986. Contract AC05-84OR21400. 431p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE87005199.

This distribution is the latest in a series published since 1978. The overall program purpose is to provide periodically updated, detailed base construction cost estimates for large nuclear electric operating plants. These data, which are representative of current US powerplant construction cost experience, are a useful contribution to program planning by the Office of the Assistant Secretary for Nuclear Energy. The eighth update incorporates the results of a comprehensive update of the technical and cost information for the pressurized water reactor (PWR), large scale prototype breeder reactor nuclear powerplant (LSPB), and 488 MWe high sulfur, coal-fired powerplant (HS5) data models. During the Phase VIII update, the LSPB, which was first incorporated into the previous update, was brought into full conformance with EEDB ground rules, and the level of detail of the data models was extended to the EEDB fully detailed level. We remind the user that the LSPB must still be considered a second-of-a-kind, pre-commercial unit, and any comparisons of it with other EEDB data models should be carefully made recognizing dissimilarity achievement of design and cost maturity, particularly for the nuclear steam supply system and other equipment.

13474 **(EIR—567) Current development status of advanced pressurized water reactors (APWRs).** Seifritz, W.; Chawla, R. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Aug 1985. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780506.

The current development status of advanced (high converting) pressurized water reactors (APWRs) is briefly reviewed. The areas covered are: reactor physics, thermohydraulics and other technical aspects, as well as electricity generating costs and long-term reactor strategical considerations related to the APWR's role in a plutonium economy. There does not seem to be any unsurmountable technical obstacle to the realization of an APWR. However, substantial further R and D efforts are required if an APWR is to go into commercial operation by the end of the century.

13475 **(EIR—571) GLAMOUR: a glass model of a pressurized water reactor.** Muelli, R. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jul 1985. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780509.

GLAMOUR is the name of an experimental loop, capable of simulating the thermohydraulic behavior of a primary loop of a pressurized water reactor under accident conditions. The primary loop of the model plant is constructed entirely of glass. It consists of these components: a reactor, a steam generator, a coolant pump and a pressurizer, connected by glass piping of 70 mm diameter. The reactor contains 37 electrically heated rods and the reactor power is adjustable between 0 and 30 kW. In the hot leg there is a connection for the pressurizer. The pressurizer is equipped with a heater and a spray system to regulate the pressure in the primary loop. Due to the glass construction the maximum primary pressure is limited to 1.5 bar. The steam generator contains 12 U-tubes, each 1 m long and 20 mm inner diameter. The coolant pump in the cold leg circulates the coolant water with insignificant pressure increase. The secondary system components are built of steel, and are located away from the primary loop so that an unobstructed view is possible from all sides. The secondary side of the steam generator is controlled by a level and pressure regulating system. The produced steam is vented to a condenser through a pressure regulating valve, and a feed pump returns the condensate to the steam generator. In this report all components of the loop are described in detail and their geometrical dimensions are compared with the dimensions of a 1000 MW nuclear plant. Several operating and simulated accident conditions of the model are presented and discussed.

13476 **(EPRI-NP—4901) Removal of a tubesheet sample from a retired Point Beach Unit 1 steam generator: Final report.** Rubrecht, R.C.; Judd, P.V.; Katterhenry, A.A. (NUS Operating Services Corp., Clearwater, FL (USA). Clearwater Operations; Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 140p. Research Reports Center, Box 50490 Palo Alto, CA 94303. File Number TI87920182.

The project described in the following report was undertaken by NUS Operating Services Corporation (NUSOSC) to remove a tubesheet sample from a steam generator that was retired from service due to corrosion damage to tubes particularly in the tubesheet. The field work was performed at the Wisconsin Electric Power Company's (WEPCO) Point Beach Nuclear Plant where two Westinghouse steam generators from the Unit 1 pressurized water reactor system are stored in an on-site storage building. The sample removed is for subsequent detailed analyses of causes of the corrosion in the crevice area between the Inconel tubes and the tubesheet. Three concepts to remove the sample were investigated by NUSOSC: drilling, plasma arc cutting, and electric discharge machining (EDM). The electric discharge machining technique was finally chosen to remove the sample. Although the report discusses all three concepts investigated, the primary emphasis is on the work activities undertaken by NUSOSC which resulted in the successful removal of a steam generator sample by EDM. A great deal of insight was gained regarding the problems involved in the removal of the sample in a high radiation environment using EDM.

13477 **(EPRI-NP—4940) Methods for evaluating steam generator hideout return data: Case study at North Anna: Final report.** Hook, T.A.; Sawochka, S.G.; Bell, M.J. (NWT Corp., San Jose, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 92p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920179.

This report details methodology appropriate for evaluating and interpreting hideout return data. The use of this methodology is illustrated with data collected during a hideout return study con-

ducted at North Anna 1 in May 1984. Significant return of sodium, potassium, sulfate, and silica occurred during the power reduction. Return of calcium and magnesium increased markedly when temperature was reduced consistent with the retrograde solubilities of calcium sulfate and serpentine ($3MgO_2 \times SiO_2 \times 2H_2O$). Approximately 10 pounds of impurities were removed from the steam generators by blowdown and draining. Chemical return during the power reduction was much greater than had been observed during any previous PWR monitoring program. This difference could be associated with the use of boric acid as a possible denting mitigation agent at North Anna 1 for approximately four years prior to the monitored shutdown. Impurity concentrations in the feedwater and steam were too low to allow development of accurate estimates of hideout during normal operation.

13478 **(EPRI-NP—4971) Application of the leak-before-break approach to Westinghouse PWR [pressurized water reactor] piping: Final report.** Swamy, S.A. (Westinghouse Electric Corp., Pittsburgh (USA). Generation Technology Systems Div.; Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 65p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920177.

NUREG 1061, Volume 3, puts forth criteria that can be used to demonstrate leak-before-break for high energy piping systems. An accepted leak-before-break methodology for PWR primary loop piping already exists. The purpose of this effort was to extend the leak-before-break methodology to high energy piping systems other than the reactor coolant loop piping. A detailed leak-before-break evaluation of the pressurizer surge line is presented in this report. The pressurizer surge line was selected as a typical case because this line would typically yield large fatigue crack growth because of the steady state fluctuations associated with the pressurizer fluid. Based on the evaluation it is concluded that for the typical surge line considered in this investigation, guillotine breaks should not be used as a part of the structural design basis. As a second part of this investigation, the high energy piping systems inside containment were prioritized from the standpoint of determining the applicability of the leak-before-break approach. The priorities were based on three considerations. First, the potential for pressure boundary failure in high energy lines with diameters 6 inches and larger was reviewed qualitatively by addressing six potential failure mechanisms. As the second consideration, the piping systems were prioritized based on cost benefit assessment. As the final consideration, the piping systems were prioritized based on quantitative assessment to determine the feasibility of demonstrating leak-before-break. An overall priority to demonstrate leak-before-break was established based on the above considerations.

13479 **(EPRI-NP—4998) PWR radiation fields at combustion engineering plants through mid-1985: Final report.** Barshay, S.S.; Beineke, T.A.; Bradshaw, R.W. (Combustion Engineering, Inc., Windsor, CT (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 99p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920243.

This report presents the results of the initial phase of the EPRI-PWR Standard Radiation Monitoring Program (SRMP) for PWR nuclear power plants with Nuclear Steam Supply Systems supplied by Combustion Engineering, Inc. The purposes of the SRMP are to provide reliable, consistent and systematic measurements of the rate of radiation-field buildup at operating PWR's; and to use that information to identify opportunities for radiation control and the consequent reduction of occupational radiation exposure. The report includes radiation surveys from seven participating power plants. These surveys were conducted at well-defined locations on the reactor coolant loop piping and steam generators, and/or inside the steam generator channel heads. In most cases only one survey is available from each power plant, so that conclusions about the rate of radiation-field buildup are not possible. Some observations are made about the distribution pattern of radiation levels within the steam generator channel heads and around the reactor coolant loops. The report discusses the relationship between out-of-core radiation fields (as measured by the SRMP) and: the pH of the reactor coolant, the concentration of lithium hydroxide in the reactor coolant, and the frequency of changes in reactor power level. In order to provide data for possible future correlations of these parameters with the SRMP radiation-field data, the report summarizes information available from participating plants on primary coolant pH, and on the frequency of changes in reactor power level. 12 refs., 22 figs., 7 tabs.

13480 **(INIS-BR—447) Quality control of the structural design of Angra 2 and 3 power reactor.** Merino, J.L.E.; de Carvalho, S.R.B. (PROMON Engenharia S.A., Rio de Janeiro (Brazil)). 1985. 24p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780517.

The quality control requirements for nuclear power plants are done by CNEN and might be followed by the organizations that are responsible for those activities, such as: design, suppliers, construction, fabrication, mounting, installation, commissioning, operation, maintenance, modification, and decommissioning. The Promon's experience for using a quality control program in the structural design of Angra 2 and 3, and the verification system adopted, are presented.

13481 **(INIS-BR—448) Development of a coarse mesh code for the solution of two group static diffusion problems.** de Barros, R.C. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). 1985. 377p. (In Portuguese). NTIS (US Sales Only), PC A17/MF A01. File Number DE86780518.

This new coarse mesh code designed for the solution of 2 and 3 dimensional static diffusion problems, is based on an alternating direction method which consists in the solution of one dimensional problem along each coordinate direction with leakage terms for the remaining directions estimated from previous interactions. Four versions of this code have been developed: AD21 - 2D - 1/4, AD21 - 2D - 4/4, AD21 - 3D - 1/4, and AD21 - 3D - 4/4; these versions have been designed for 2 and 3 dimensional problems with or without 1/4 symmetry.

13482 **(LCC—019/85) Finite element model for the quench front evolution problem.** Folescu, J.; Galeao, A.C.N.R.; do Carmo, E.G.D. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). 1985. 6p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780544.

A model for the rewetting problem associated with the loss of coolant accident in a PWR reactor is proposed. A variational formulation for the time-dependent heat conduction problem on fuel rod cladding is used, and appropriate boundary conditions are assumed in order to simulate the thermal interaction between the fuel rod cladding and the fluid. A numerical procedure which uses the finite element method for the spatial discretization and a Crank-Nicolson-like method for the step-by-step integration is developed. Some numerical results are presented showing the quench front evolution and its stationary profile.

13483 **(ORNL-tr—86/74) Device for horizontal transfer between two enclosures of nuclear fuel elements stored in vertical position.** Faucond, J. (Oak Ridge National Lab., TN (USA); Alsthom-Atlantique, 75 - Paris (France)). 1986. Contract AC05-84OR21400. Translation of French Patent No. 82 00798, July 22, 1983. 22p. NTIS, PC A02/MF A01. File Number DE87004643.

The invention involves a device for horizontal transfer between two enclosures of nuclear fuel elements stored in vertical position. This device is specifically applicable to nuclear power plants of the pressurized water type (PWR), in which the fuel elements are in the form of bars with, for example, a length of two meters and a rectangular cross-section of approximately 200 x 100 mm. When they are placed in service, these elements are introduced vertically, using a loading machine, into the reactor core contained in a pressure vessel. When they are spent, they are removed by the same machine and deposited temporarily, element by element, still in the vertical position, in an unloading basin above the reactor vessel. They are then transferred to a spent fuel pit located, for example, at a distance of 10 meters from the unloading basin, at practically the same level, where they are stored in vertical position until the natural decay of their radioactivity allows them to be removed from the power plant. Water, in fact, serves the function of

cooling the elements and protecting the external environment against part of the radiation.

13484 **Determination of the coolant and core status during the TMI-2 accident from the ex-core detector responses.** Wu, H.Y. University Park, PA; Pennsylvania State Univ. (1986). 170p. University Microfilms Order No. 86-23,813.

Thesis (Ph. D.).

This work investigated the ex-core detector response in a pressurized water reactor (PWR) during a small-break loss of coolant accident (LOCA), such as occurred at the Three Mile Island unit 2 (TMI-2) Nuclear Generating Station. The ex-core detector responses during several small-break LOCA experiments and the TMI-2 accident were analyzed. From this analysis, the progression of the core damage during the RMI-2 accident was determined. This analysis represents the first complete study of the source range monitor response and includes a determination of the coolant status, control rod melting, and fuel relocation during the TMI-2 accident. The study provides the first complete interpretation of the anomalous behavior of the SRM during the accident. The sensitivity study shows that the ex-core detector response depends on the region where voiding occurs. Voiding or a water level decrease in the downcomer region has a major effect on neutron leakage, and voiding or a water level decrease in the core region has the effect on the neutron multiplication and source strength in the core. An analysis of the source range monitor (SRM) response during TM-2 accident indicates that the response of the ex-core detector contains information on the coolant and core status during a small-break LOCA.

2103 Power Reactors, Non-breeding, Graphite Moderated

13485 **(EIR—564) MCNP benchmark calculation: GCFR grid-plte shield design, configuration II.A.** Arkuszewski, J.J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jul 1985. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780504.

This report describes the Monte Carlo MCNP analysis of one of the GCFR Shield Design experimental configurations which has been constructed and analyzed at the Test Shielding Facility in ORNL. It is a part of the benchmarking program for MCNP, which has been agreed upon with HRB, Mannheim. The calculated response results for the selected detectors agree within 10% with the measured ones, what can be considered as a very good agreement. The code appears to be a reliable tool for the analysis of similar systems.

13486 **(UNI-SA—179) Flux flattening in a graphite moderated core.** Burnside, R.J.; Skeen, D.R.; Finfrock, S.H.; Robinson, A.H.; Toffer, H. (UNC Nuclear Industries, Inc., Richland, WA (USA)). 12 Nov 1986. Contract AC06-76RL01857. 24p. (CONF-861102—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002689.

From American Nuclear Society and Atomic Industrial Forum joint meeting; Washington, DC, USA (16 Nov 1986).

An axial flux flattening program was instituted at N Reactor to lower the peak to average flux from 1.45 to the 1.25-1.30 range. Axially varying fuel enrichments are being used to accomplish the reduced peaking. The flux flattening program objectives are to improve operational constraints, safety margins, nuclear material production, and to homogenize fluence impacts upon the graphite moderator for the rest of the reactor's life. Development of numerical methods and computer models to provide design information was key to the program's success.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

13487 **Modeling of condensation heat transfer in a reactor containment.** Kim, M.H. Madison, WI; Univ. of Wisconsin (1986). 272p. University Microfilms Order No. 86-15,643.

Thesis (Ph. D.).

A simple condensation model for forced and natural convection in the presence of a noncondensable gas is derived by using the analogy between mass, momentum, and energy transfer. The effects of a wavy interface are implemented in this model by using correlations for the rough wall surface. A two dimensional condensation model using a k-epsilon model for the turbulent vapor air flow was also developed to investigate the effect of two-dimensional flow and to provide a sound theoretical basis for the simple model. Each model is compared with the available separate effects experimental data. The forced convection model is then compared to the Carolinas Virginia Tube Reactor (CVTR) integral test by using the vapor-air velocity predicted by a separate two dimensional fluid dynamics model. The effect of countercurrent flow is also considered in this comparison. The natural convection model is also compared to the steady state integral data of Tagami. The comparison shows good agreement with both sets of experimental data.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 13473, 13507, 13511, 13512, 13520, 13534

13488 **Thermal performance of fresh mixed-oxide fuel in a fast flux LMR.** Ethridge, J.L.; Baker, R.B. (Hanford Engineering Development Lab., Richland, WA). pp 2485-2490 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

A test was designed and irradiated to provide power-to-melt (heat generation rate necessary to initiate centerline fuel melting) data for fresh mixed-oxide UO/sub 2/-PuO/sub 2/ fuel irradiated in a fast neutron flux under prototypic liquid metal reactor (LMR) conditions. The fuel pin parameters were selected to envelope allowable fabrication ranges and address mass production of LMR fuel using sintered-to-size techniques. The test included fuel pins with variations in fabrication technique, pellet density, fuel-to-cladding gap, Pu concentration, and fuel oxygen-to-metal ratios. The resulting data base has reestablished the expected power-to-melt in mixed-oxide fuels during initial reactor startup when the fuel temperatures are expected to be the highest. Calibration of heat transfer models of fuel pin performance codes with these data are providing more accurate capability for predicting steady-state thermal behavior of currents and future mixed-oxide LMR fuels.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

13489 **(DOE/NASA/1005—10) Overview of NASA Lewis Research Center free-piston Stirling engine technology activities applicable to space power systems.** Slaby, J.G. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1987. Contract AI05-82OR21005. 11p. (NASA-TM—88815; CONF-870102—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE86014816.

From 4. symposium on space nuclear power systems; Albuquerque, NM, USA (12 Jan 1987).

An overview is presented of the National Aeronautics and Space Administration (NASA) Lewis Research Center free-piston Stirling engine activities directed toward space-power application. One of the major elements of the program is the development of advanced power conversion concepts of which the Stirling cycle is a viable candidate. Under this program the research findings of the 25 kWe opposed-piston Space Power Demonstrator Engine (SPDE) are presented. Included in the SPDE discussion are initial differences between predicted and experimental power outputs and power output influenced by variations in regenerators. Projections are made for future space-power requirements over the next few decades. A cursory comparison is presented showing the mass benefits that a Stirling system has over a Brayton system for the same peak temperature and output power.

13490 **Reflected kinetics model for nuclear space reactor kinetics and control scoping calculations.** Washington, K.E. College Station, TX; Texas A and M Univ. (1986). 168p. University Microfilms Order No. 86-15,006.

Thesis (Ph. D.).

Renewed interest in space nuclear applications has motivated the study of a specialized reactor kinetics model. Consideration of a kinetics model favorable for study of the feasibility of automatic control of these devices is warranted. The need to bridge this gap between reactor kinetics and automatic control in conjunction with the control drum design characteristic of next generation paper space reactors inspired the development of a new Reflected Kinetics (RK) model. An extension of the conventional point-kinetics (PK) model was done in order to explicitly correlate reactivity and the reflector/absorber control drums characteristic of space nuclear reactor designs. Open-loop computations and numerical comparison to analytic PK equations indicated that the RK model is a functional alternative to equivalent bare point kinetics in the analysis of moderate transients. Variations in the RK reflector-to-core transfer probabilities and coolant flow rate do indeed drive the transient differently than the lumped insertion of equivalent reactivity amounts in the core. These computations illustrated the potential importance of the utilization of variable coolant flow rate to aid control in space reactor systems limited by minimal drum reactivity worth. Additionally the Doppler reactivity shutdown mechanism was concluded to be the primarily reliable means of safety shutdown in such systems. The structure of the RK equations proved to be advantageous for integration of automatic control.

2107 Regulation And Licensing

13491 **(NUREG—0540-Vol.8-No.10) Title list of documents made publicly available, October 1-31, 1986.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Dec 1986. 478p. NTIS, PC A21/MF A01 - GPO. File Number TI87900458.

This document is a monthly publication containing descriptions of information received and generated by the US NRC. This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author Index, Corporate Source Index, Report Number Index, and Cross Reference to Principal Documents Index.

13492 **(NUREG—0540-Vol.8-No.11) Title list of documents made publicly available, November 1-30, 1986.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jan 1987. 374p. NTIS, PC A16/MF A01 - GPO. File Number TI87900457.

This document is a monthly publication containing description of information received and generated by the US NRC. This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author Index, Corporate Source Index, Report Number Index, and Cross Reference to Principal Documents Index.

13493 **(NUREG/CR—2000-Vol.5-No.10) Licensee Event Report (LER) compilation for month of October 1986.** (Oak Ridge National Lab., TN (USA). Nuclear Safety Information Center; Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Nov 1986. Contract AC05-84OR21400. 148p. (ORNL/NSIC—200-Vol.5-No.10). NTIS, PC A07/MF A01 - GPO. File Number TI87002464.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-1061, "Instructions for Preparation of Data Entry Sheets for Licensee Event Reports." For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 - "Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System - Description of Systems and Guidelines for Reporting," provides supporting guidance and information on the revised LER rule.

13494 **(NUREG/CR—2000-Vol.5-No.11) Licensee event report (LER) compilation for month of November 1986.** (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 108p. (ORNL/NSIC—200-Vol.5-No.11). NTIS, PC A06/MF A01 - GPO. File Number TI87003665.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERS, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-1061, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 - Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System - Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule.

13495 **Method for developing cost estimates for generic regulatory requirements.** Ball, J.R.; Cohen, S.; Sege, G.; Ziegler, E.J. (Argonne National Lab., IL). *Transactions of the American Nuclear Society;* **49**: 352-354(1985).

A six-step technique can help the Nuclear Regulatory Commission (NRC) prepare cost estimates of proposed new or revised generic requirements for reactor licensing and to assign priorities in the resolution of generic safety issues. The authors apply this method to commercial light water reactor power plants. The cost-estimating model is based on a list of functional responses carried out by the various sectors in implementing an NRC requirement. The model distinguishes between those units which are in the planning or early construction stages, those well under construction, and those which are operating. 3 references, 1 figure.

2108 Economics

REFER ALSO TO CITATION(S) 13473, 13495

22 NUCLEAR REACTOR TECHNOLOGY

13496 **(AD-A—174009/1/XAB) Applications and uses of the ADALAB-PC hardware and LABTECH NOTEBOOK software integrated data-acquisition system. Master's thesis.** Lubatti, R.W. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Dec 1986. 94p. NTIS, PC A05/MF A01.

The purpose of this paper is to familiarize the reader with the use and application of the ADALAB-PC hardware and LABTECH NOTEBOOK software package recently acquired by the Pennsylvania State University's Nuclear Engineering Department. The ADALAB-PC (manufactured by Interactive Microware) is an analog and digital laboratory system designed specifically for the IBM-PC. LABTECH NOTEBOOK (developed by Laboratory Technologies) is a menu-driven software system that provides the required interface between the systems user and the instrumentation system. This paper demonstrates how ADALAVB-PC and LABTECH NOTEBOOK can be used to collect real time data from a

power-plant measurements experiment. The real-time data (pressure versus temperature) is obtained by using a pressure vessel equipped with resistance thermometer and a pressure transducer. The analog voltage signals from the resistance thermometer and pressure transducer are converted to digital signals through the use of ADALAB-PC's analog-to-digital converter. In this paper the experimental results are compared to the theoretical values as reported in the American Society of Mechanical Engineers Steam Tables handbook. The experiment has been written up as a student laboratory procedure.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 13973

13497 **(ANL—7416-Suppl.3) National Energy Software Center: benchmark problem book. Revision.** (Argonne National Lab., IL (USA)). Dec 1985. Contract W-31-109-ENG-38. 446p. NTIS, PC E13/MF $6.35; 3; GPO Dep. File Number DE86012678.

Computational benchmarks are given for the following problems: (1) Finite-difference, diffusion theory calculation of a highly nonseparable reactor, (2) Iterative solutions for multigroup two-dimensional neutron diffusion HTGR problem, (3) Reference solution to the two-group diffusion equation, (4) One-dimensional neutron transport transient solutions, (5) To provide a test of the capabilities of multi-group multidimensional kinetics codes in a heavy water reactor, (6) Test of capabilities of multigroup neutron diffusion in LMFBR, and (7) Two-dimensional PWR models.

13498 **(AREAEE—277) Study on physics parameters and flux behavior for a fast critical facility using "Baker" model.** Abu-Leilah, M.M.; Hussein, A.Z.; Gaafar, M.A.; Hamouda, I.F. (Nuclear Research Centre, Inshas (Egypt)). 1983. 41p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780490.

Comparative study was performed to emphasize the effects of using different nuclear data systems and methods on the various parameters of the fast reactor. Multigroup libraries as 11 (ANL-5800) and 26 (BNAB-64) energy group systems of nuclear data constants were used in the present work. The calculations were carried out for both infinite dilution (self-shielding factor F = 1) and self-shielded cross sections. Various computer codes were elaborated and derived to meet the conditional requirements for such calculations. The important outputs of these calculations are the neutron spectra, neutron balance, fission and capture rate distributions, critical mass, breeding ratio in each region, and total breeding ratio of the reactor. Five different cases of study were considered employing two systems of constants, infinite dilution and self-shielded cross-sections and treating stainless steel of the reactor as to be substituted by iron. Moreover, calculations have been concerned for averaged one group nuclear data constants which were condensed from the 11 and 26 group systems. Comparisons of the multigroup results with those of the group were made. The condensation process for averaging to one group was done to estimate the effect of such physical simplification on the calculated parameters. The present work results have been compared with many published works. Fair agreements are obtained, which verified the consistence and completeness of the methods implemented and used.

13499 **Analysis of infinite domain criticality zones in finite reactors.** Salimi, B. Urbana, IL; Univ. of Illinois (1986). 144p. University Microfilms Order No. 86-23,399.

Thesis (Ph. D.).

A reactor that is infinitely large has two ideal properties: (1) The fission rate density and, hence, the power are uniform throughout, and (2) the fuel density needed for criticality is minimum. A finite reactor loaded in this way would be subcritical and would have to contain additional fuel to compensate for neutron leakage to sustain criticality. The performance of two reactor models is analyzed on the basis of the multi-group diffusion approximation. Both models comprise a primary inner core zone which would be critical if it were infinite in extent. In the first model, the primary core zone is surrounded by a secondary core which is loaded to achieve a specific power density (i.e., fission rate density). The exact solutions of the multi-group diffusion equations are obtained for up to four energy groups. In the second model, the primary core zone contains a thin spherical fission plate. The exact solutions of the one- and two-group diffusion equations are obtained. A numerical example for each model is worked out to show the distribution of flux, fuel loading, and power, for the one- and two-group cases. Finally, the problem of uniform power in a two-dimensional assembly is analyzed. Formal analytic solutions are obtained, with one-and two-group equations, in a semi-infinite slab, and a finite cylinder.

2202 Components And Accessories

13500 **(AAEC/E—614) Comparison of neutron resonance absorption in thermal reactor lattices in the AUS neutronics code system with Monte Carlo calculations.** Robinson, G.S. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Aug 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780484.

The calculation of resonance shielding by the subgroup method, as incorporated in the MIRANDA module of the AUS neutronics code system, is compared with Monte Carlo calculations for a number of thermal reactor lattices. For the large range of single rod and rod cluster lattices considered, AUS results for resonance absorption were high by up to two percent.

13501 **(AREAEE—271) Effect of reactor finiteness on the boundary condition at the surface of a booster section.** Wassef, W.A. (Nuclear Research Centre, Inshas (Egypt)). 1982. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780487.

Effect of reactor finiteness on the boundary condition at the surface of an absorbing booster embedded in the reactor core is studied and formulated. The model used in these calculations depends on the Pl-Transport coupling technique. This method takes into consideration the rigorous neutron transport behavior inside the booster medium, while the Pl-approximation in the bulk of the scattering medium surrounding the booster which can be considered infinite in most practical applications. The neutron flux gradient parallel to the surface of the booster is considered. The geometrical configuration of the reactor core cross section is circular or rectangular. Finiteness of the reactor is introduced in the general formulation through its dimensions or buckling. Extensive numerical results are given to demonstrate the dependence of the boundary condition at the surface of the booster section on the reactor finiteness and the different physical parameters.

13502 **(AREAEE—274) Comparative studies of parameters based on the most probable versus an approximate linear extrapolation distance estimates for circular cylindrical absorbing rod.** Wassef, W.A. (Nuclear Research Centre, Inshas (Egypt)). 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780488.

Estimates and techniques that are valid to calculate the linear extrapolation distance for an infinitely long circular cylindrical absorbing region are reviewed. Two estimates, in particular, are put into consideration, that is the most probable and the value resulting from an approximate technique based on matching the integral transport equation inside the absorber with the diffusion approximation in the surrounding infinite scattering medium. Consequently, the effective diffusion parameters and the blackness of the cylinder are derived and subjected to comparative studies. A computer code is set up to calculate and compare the different parameters, which is useful in reactor analysis and serves to establish beneficial estimates that are amenable to direct application to reactor design codes.

13503 **(EPRI-NP—4889) Status of nuclear Class 1 component requalification: Final report.** Cooper, W.E. (Teledyne Engineering Services, Waltham, MA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920181.

Qualification relates to assurance of acceptability of the component with respect to structural integrity, operability and functional capability. Requalification is required if existing qualification is

lost because of: expiration of the qualified service life (life extension); reactivation of a cancelled or suspended plant; failure to conform with certain requirements of the Technical Specifications, or revision to the applicable Regulatory requirements. The alternatives to requalification are replacement or removal from service. The choice between requalification, replacement and removal from service is governed by economics. The purpose of requalification standards is to ensure the acceptability of the requalification process. A previous EPRI Report prepared by Teledyne Engineering Services (TES) (NP-1921) developed a rationale for, and a draft of, a generic requalification standard for Class 1 Pressure Boundary Components presently considered by the Boiler and Pressure Vessel Code published by The American Society of Mechanical Engineers (ASME/BPVC). International Energy Associates Limited (IEA) prepared another report for EPRI shortly thereafter (NP-2418), which reviewed the economic and technologies factors of nuclear plant life extension, and concluded that NP-1921 makes a strong case that the nuclear industry will benefit from the development of the proposed standard.

13504 **(HEDL-SA—3394) Damage rate and spectrum effects in ferritic steel ΔNDTT data.** Simons, R.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76FF02170. 41p. (CONF-860605—38). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004436.

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

A model was developed for irradiation-induced hardening in pressure vessel steels by cascade-induced nucleation and free defect diffusion of copper to coherent copper clusters. The model was used as a functional framework for fitting data on ΔNDTT as a function of damage dose and dose rate. Several defect cross sections having different neutron energy dependences were tried. The cross section for Frenkel pair production, based on resistivity measurements at 4 K, was found to give a comparable or slightly better fit to the data than dpa. Damage rate is an important parameter to consider in correlation of ΔNDTT data and damage rate can affect the nucleation as well as the growth of the copper precipitation.

13505 **(NUREG/CR—3656) Evaluation of suppression methods for electrical cable fires.** Chavez, J.M.; Lambert, L.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1986. Contract AC04-76DP00789. 91p. (SAND—83-2664). NTIS, PC A05/MF A01 - GPO. File Number TI87003027.

The electrical cable fire suppression tests conducted at Sandia National Laboratories were performed to provide confirmatory research for the US Nuclear Regulatory Commission (NRC) on suppression systems effectiveness. This report describes full-scale tests on both horizontally and vertically oriented cable trays, filled with either IEEE-383 qualified cables or unqualified cables, to determine the effectiveness of Halon 1301, water sprinklers, directed water spray, and carbon dioxide fire suppression systems. These four methods of fire suppression were evaluated to determine their effectiveness in suppressing both exposure type and fully developed type cable tray fires. The results show that although all methods of suppression were effective, given sufficient suppressant concentrations, spray durations, and soak times, the water suppression methods were the most effective. Despite their effectiveness in suppressing cable fires, it was observed that both gaseous and water suppressants may cause or permit damage to nonburning cables and equipment. The adverse environments associated with the fire and suppression related activities (e.g., high temperatures, humidity, corrosiveness) could damage cables and equipment and result in immediate or latent damage. Occurrence or likelihood of these failures was not investigated in this test series.

13506 **Basic research on intelligent robotic systems operating in hostile environments: New developments at ORNL.** Barhen, J.; Babcock, S.M.; Hamel, W.R.; Oblow, E.M.; Saridis, G.N.; deSaussure, G.; Solomon, A.D.; Weisbin, C.R. (Oak Ridge National Lab., Oak Ridge, TN 37831). pp 105-116 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

Robotics and artificial intelligence research carried out within the Center for Engineering Systems Advanced Research (CESAR) is presented. Activities focus on the development and demonstration of a comprehensive methodological framework for intelligent machines operating in unstructured hostile environments. Areas currently being addressed include mathematical modeling of robot dynamics, real-time control, "world" modeling, machine perception and strategy planning.

2204 Control Systems

13507 **(HEDL-SA—3381-FP) MIDAS [Master Information and Data Acquisition System].** Ball, D.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1986. Contract AC06-76FF02170. 7p. (CONF-860311—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004088.

From Nuclear power plant maintenance meeting; Salt Lake City, UT, USA (23 Mar 1986).

The Master Information and Data Acquisition System (MIDAS) is a computerized work control system that provides 24-hour, real-time access to plant equipment information and work package status. It is used in the 400 Area of the Department of Energy (DOE) Hanford Site in Richland, Washington. MIDAS was originally created to aid in the release and control of work at the Fast Flux Test Facility (FFTF), which is operated by the Westinghouse Hanford Company for the DOE. After MIDAS performed that function at FFTF successfully for over two years, its role was expanded to provide similar functions for other facilities supporting the LMR mission. Through its ability to provide online, accurate information on plant components, safety criteria, and work package status, MIDAS reinforces Operations functions and the control and authorization of maintenance activities in the FFTF plant and in other related facilities. Thus, MIDAS enhances the operational safety, as well as the planning and scheduling process for these facilities. MIDAS consists of three parts: The Plant Tracking System (PTS), the Work Control Log (WCL), and the MIDAS Component Indices (MCI).

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 13541, 13548

13508 **(DOE/NBM—7003140) Management of waste heat at nuclear power plants: Its potential impact on the environment and its possible economic use.** Tsai, Y.H. (Argonne National Lab., IL (USA)). [1987]. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF A01 - GPO. File Number TI87003140.

The efficacy of the disposal of waste heat from nuclear power plants by means of once-through and closed-cycle cooling systems is examined in the context of the physical aspects of water quality standards and guidelines for thermal discharges. Typical thermal standards for each of the four classes of water bodies (rivers, lakes, estuaries, and coastal waters) are identified. Examples of thermal standards established for once-through cooling on open coastal waters are presented. The design and general layout of various types of cooling systems are reviewed. The advantages and disadvantages of each of the cooling systems are presented, with particular emphasis on the discussion of potential environmental impacts. Modeling techniques available for impact assessment are presented. Proper selection and application of the models depend on the availability of site characteristics and understanding of the modeling techniques. Guidelines for choosing an appropriate model are presented. Various methods have been developed for the beneficial use of waste heat largely dissipated to the environment. Examples and associated problems of waste-heat utilization are discussed for agricultural, industrial, aquacultural, and residential uses.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 13520, 13529, 13534, 13542

13509 **(CIN-AI—004) Nuclear research reactors.** (Centro de Informacoes Nucleares, Rio de Janeiro (Brazil)). 1985. 114p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780497.

Data are presented about nuclear reserch reactors in the world, retrieved from the Sien (Nuclear and Energetic Information System) data bank. The information is organized in table forms as follows: research reactors by countries; research reactors by type; research reactors by fuel; and research reactors by purpose.

13510 **(EIR—573) Aberration in the attenuation of the activity of threshold detectors measured in the pool of the swimming-pool reactor SAPHIR.** Paratte, J.M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Oct 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780510.

Fast neutron flux attenuation as function of the distance from the reactor core center was measured in the pool water of the SAPHIR swimming pool reactor by means of activated detectors. After about 80 cm, the curve of the Rhodium and Indium detectors based on the activation of the isomeric level, becomes flatter, while the Phosphorus detectors based on the (n,p) reaction behave as would be predicted. Comparative calculations demonstrated that Rhodium and Indium were activated by a nuclear fluorescence reaction (gamma,gamma), which predominates after an attenuation of the neutron flux of about 5 decades.

13511 **(HEDL-SA—3364-FP) Fast Flux Test Facility replacement of a primary sodium pump.** Krieg, S.A.; Thomson, J.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 15 Nov 1985. Contract AC06-76FF02170. 8p. (CONF-860311—12). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004092.

From Nuclear power plant maintenance meeting; Salt Lake City, UT, USA (23 Mar 1986).

The Fast Flux Test Facility is a 400 MW Thermal Sodium Cooled Fast Reactor operated by Westinghouse Hanford Company for the US Department of Energy. During startup testing in 1979, the sodium level in one of the primary sodium pumps was inadvertently raised above the normal height. This resulted in distortion of the pump shaft. Pump replacement was carried out using special maintenance equipment. Nuclear radiation and contamination were not significant problems since replacement operations were carried out shortly after startup of the Fast Flux Test Facility.

13512 **(HEDL-SA—3508-FP) Large remote manipulator operating and maintenance experience at the IEM [Interim Examination and Maintenance] Cell.** McGuinness, P.W.; Hicks, D.F. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76FF02170. 18p. (CONF-870301—15). NTIS, PC A02/MF A01. File Number DE87004089.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

The Interim Examination and Maintenance (IEM) Cell at the Fast Flux Test Facility (FFTF) has two large Electro-Mechanical Manipulators (EMM's). These manipulators are used for cell operations (processing of reactor core components) as well as general cell maintenance. From our 8 years of operation and maintenance experience with these large EMM's, we have learned many lessons concerning manipulator design for hostile environments. This paper describes the IEM Cell EMM design features and discusses operating and maintenance experience at the IEM Cell.

13513 (INIS-mf—10100, pp 22) **Determining of the neutron absorbed doses in fast neutron fields at the RB reactor.** Sokcic-Kostic, M.; Tomasevic, D.; Pesic, M.; Antic, D.; Ninkovic, M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13514 **(KURRI-TR—258) Thermal-hydraulic analysis for core conversion to the use of low-enriched uranium fuels in the KUR.** Mishima, Kaichiro; Kanda, Keiji; Shibata, Toshikazu. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Dec 1984. 89p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86780541.

Thermal-hydraulic analysis was made for LEU fuels in the KUR. Five fuel element geometries are studied. Their dimensions are assumed as combnations of the following parameters, keeping the outer dimensions of element unchanged: meat thickness = 0.50 and 0.61mm, clad thickness = 0.51 and 0.38mm, channel thickness = 2.81 and 2.20mm. Fuel plates are assumed to be either curved or flat and the number of fuel plates ranged from 18 to 22 according to the change in the dimensions. For each fuel element, the relation between the pressure loss and the flow rate, critical heat flux, and heat fluxes for the onset of flow instability and the onset of nucleate boiling are calculated using the computer code PLTEMP3 which has been developed for this study. The effect of fuel material (UAl/sub x/-Al, U_3O_8-Al and U_3Si_2-Al) on the peak fuel temperature is also studied. As a particular interest in the mixed core which may be constructed on the way to the use of LEU fuels, the change in the bypass flow rate due to the change in the gap between different fuel elements is investigated. The results indicate that no significant problem arises due to core conversion for the use of LEU fuels in view of core thermal-hydraulics. With the assumptions used in the analysis and assuming that the permissible minimum margin to ONB be 1.2, the total peaking factor should be lower than 3.3 as far as the primary cooling system is unchanged.

13515 **(NUCLEBRAS-CDTN—504) Survey of the thermal and fast neutron flux distribution in the core of IPR-R1 reactor.** Guimaraes, R.R.R. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1985. 138p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. File Number DE86780547.

A methodology to obtain the neutron flux distribution inside the core of a reactor is presented, aiming to analyze specifications for increasing reactor power. The activation measurement technique with irradiation of steel electrodes of 700 mm of length, put in acrylic rods was used. In the detection process and in the counting of activation product, a Ge (Li) detector with high resolution and a scanning mechanical system, constructed and projected in CDTN (Nuclear Technology Development Center) were used.

13516 **(UTNL-R—0152) Report of the research results with University of Tokyo, Nuclear Engineering Research Laboratory's Facilities in fiscal 1982.** (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). 1984. 152p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number DE86780553.

The results of the research carried out in fiscal 1982 commonly using the facilities in the Nuclear Engineering Research Laboratory, University of Tokyo, are summarized in this report. In the utilization of the nuclear reactor, the maximum output was limited to 500W, because it was necessary to examine the growth of the abnormal protrusion having arisen on fuel cladding. The linear accelerator was utilized almost perfectly. The total number of those who commonly utilized the facilities was 2468, suggesting the importance of the role of common utilization. The summaries of the results of 12 on-pile researches, 11 off-pile researches and 18 researches using the linear accelerator are collected. The committee meetings held in fiscal 1982 are listed. The names of the members of various committees and the names of those in charge of various experiments are given.

13517 **(UTNL-R—0164) Report of the research results with University of Tokyo, Nuclear Engineering Research Laboratory's Facilities in fiscal 1983.** (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). 1984. 165p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number DE86780554.

Much achievement was obtained also in fiscal 1983 by the common utilization of the nuclear reactor "Yayoi" and the linear accelerator in the Nuclear Engineering Research Laboratory, University of Tokyo. These results were summarized, and this report is published. In the utilization of the reactor "Yayoi", the period of operation and the maximum output were limited very much, because long cooling period is necessary to prepare for the repair of fuel cladding in the next year. Also, foreign research students commonly utilized the reactor "Yayoi". The common utilization of the linear accelerator was begun six years ago, and now it is carried out widely and smoothly. The total number of those who commonly utilized the facilities reached 3179. The summaries of the results of 5 on-pile researches, 17 off-pile researches, and 16 researches using the linear accelerator are collected. The committee meetings and study meetings held in fiscal 1983 are listed. The names of the members of various committees and the names of those in charge of various experiments are given.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 13521, 15091, 15092, 15093, 15094, 15095, 15096, 15097, 15098, 15099, 15100, 15101

13518 (DPST—86-1-11) Savannah River Laboratory: Monthly report. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1986. Contract AC09-76SR00001. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004293.

Activities at the Savannah River Plant are reported for the month of November 1986 in the areas of nuclear reactor technology and scientific computations, chemical processes and environmental technology, and defense waste processing. (LEW)

2209 Reactor Safety

REFER ALSO TO CITATION(S) 13426, 13471, 13484, 13487, 13490, 14369

13519 (BNL-NUREG—38836) Investigation of failed Type 410 stainless steel shafts from main steam isolation valves at two operating plants. Czajkowski, C.J. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 15p. (CONF-870314—4). NTIS, PC A02/MF A01 - GPO. File Number TI87002587.

From Corrosion '87; San Francisco, CA, USA (9 Mar 1987).

Metallurgical investigation were performed on a cracked main steam isolation valve (MSIV) shaft from the Joseph M. Farley Unit No. 1 station and two MSIV shafts from the R.E. Ginna Station (only one shaft cracked). This investigation consisted of optical microscopy, chemical analysis, hardness testing, scanning electron microscopy and energy dispersive spectroscopy. The shafts were manufactured from ASTM A276, Type 410 stainless steel in the quenched and tempered condition. The crack on the Farley shaft ran longitudinally and was approximately 16.7 cm (6.6 inches) in length. The crack on the Ginna shaft was approximately 7.6 cm (3 inches) in length and ran almost perpendicularly to the shaft's long axis. The second Ginna shaft had no visible cracks. Hardness measurements of the shafts revealed that the Farley shaft hardness values ranged between R/sub c/ 41 to 44.5, the cracked Ginna shaft values ranged between R/sub c/ 42.9 to 45, while the uncracked shaft's hardness was R/sub c/ 36 to 44.6. The cracks were intergranular and occurred on prior austenite grain boundaries. No evidence of corrosive species or fatigue contribution was seen. This cracking is considered to be an intergranular stress corrosion cracking phenomenon resulting from a high hardness/susceptible material in a pressurized water environment.

13520 (CONF-870304—2) Validation of the HOTCHAN code for analyzing the EBR-II driver following loss of flow without scram. Mohr, D.; Chang, L.K.; Betten, P.R.; Feldman, E.E.; Planchon, H.P. (Argonne National Lab., IL (USA)). 1987. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. File Number DE86010527.

From 2. ASME/JSME thermal engineering conference; Honolulu, HI, USA (22 Mar 1987).

A series of experiments involving unprotected (no scram) loss-of-primary flow (LOF) down to natural convection was successfully conducted in February 1985 on the Experimental Breeder Reactor-II (EBR-II). The predicted and measured behavior of a special instrumented assembly, the XX09 fueled INSAT, is compared for the most severe test in the group to demonstrate the validation of the thermal-hydraulic code HOTCHAN. The particular test of interest in this paper was initiated at full power by tripping the primary and secondary pumps. These tests were part of the Shutdown Heat Removal Tests (SHRT) being conducted in EBR-II. The reactor and balance of plant are extensively instrumented and measurements were recorded by a data acquisition system. The reactor and plant response confirm predictions that the driver fuel cladding can survive temperatures above the eutectic threshold for the transient following a station blackout without scramming the reactor. The incore data provide an additional basis for validation of the recently developed HOTCHAN code for analyzing the thermal-hydraulic behavior of specific fuel subassemblies. In this paper the analytical model for HOTCHAN will be described as well as its relationship to the NATDEMO code. The predicted behavior of the hottest driver subassembly is also discussed and compared with XX09 results.

13521 (DOE/EH—0017) Design review of the N Reactor. (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Nuclear Safety). Sep 1986. 183p. NTIS, PC A09. File Number DE87003060.

This review of the design features of the N Reactor was initiated at the request of the Secretary of Energy, John S. Herrington, shortly after, and as a consequence of, reports of the accident at the Soviet reactor complex located at Chernobyl, on April 26, 1986. In the review, special attention was given to those plant systems which are most important in preventing the release of radioactive materials from the plant in the event of combined major equipment failures and human errors. Also, the review studied the potential effects of various severe accident sequences, and addressed the question of whether an event similar in causes or consequences to the Chernobyl accident could occur in the N Reactor. In light of experiences at both Three Mile Island and Chernobyl, the potential for accumulation of hydrogen in excess of flammable limits was given particular attention. The review team was also asked to identify possible improvements to the N Reactor plant, and to evaluate the effects and significance of service-induced degradation. The overall conclusion of the design review is that the N Reactor is safe to operate and that there is no reason to stop or alter its operation in any major respect at this time. Certain additional analyses and testing, are recommended to provide a firmer basis for decisions on long-term operation and on measures which may be needed in the future to accommodate long-term operation.

13522 (DOE/SSDP—0011) Asbestos insulation removal at the Shippingport Station Decommissioning Project. Bauer, R.G. (UNC Nuclear Industries, Shippingport, PA (USA). Shippingport Decommissioning Project Office). 1986. Contract AC06-76RL01857;AC06-84RL10421. 10p. (CONF-860905—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE87000420.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

The purpose of this paper is to transfer technology developed during the asbestos removal at the Shippingport Station Decommissioning Project (SSDP). The information is provided to assist engineering personnel preparing for asbestos removal. A brief background of the project and its specific considerations are given. Engineering decisions, lessons-learned and recommendations are presented to assist in the avoidance of contracting, safety, and technical difficulties.

13523 (DP-MS—86-202) An improved air-supplied plastic suit for protection against tritium. Wiernicki, C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1987. Contract AC09-76SR00001. 12p. (CONF-870135—1). NTIS, PC A02/MF A01. File Number DE87004513.

From 2. international performance of protective clothing symposium; Tampa, FL, USA (18 Jan 1987).

A newly developed Saran/CPE plastic suit material is described which offers significantly better protection against HTO penetration and permeation than the 12-mil PVC currently used at SRP and most other DOE and commercial sites where tritium and HTO are exposure hazards. Tritium breakthrough time is an important parameter when evaluating the applicability of protective clothing; previously published tritium permeation tests did not measure this parameter. Future studies should quantify steady-state permeation rate and breakthrough time to more fully evaluate potential tritium protective clothing. Saran/CPE has successfully been fabricated into a plastic suit because, in addition to its superior tritium resistance, it has all the characteristics required to construct a rugged, dependable, and comfortable suit. The use of the Saran/CPE suit at SRP reactor and tritium production facilities should be a major contribution to the site As Low As Reasonably Achievable program. Both Saran/CPE have demonstrated excellent resistance to a wide range of chemical contaminants; therefore, this suit material may have applications in the general chemical industry and hazardous waste site cleanup operations. 4 refs., 3 figs., 1 tab.

13524 **(EGG-M—21886) Code uncertainty quantification.** Odar, F.; Hanson, R.G. (Nuclear Regulatory Commission, Rockville, MD (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 11p. (CONF-8610135—50). NTIS, PC A02/MF A01 - GPO; 1; GPO Dep. File Number DE87004537.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

This paper presents an overview of a methodology developed to quantify reactor safety computer code uncertainty. The methodology development program is supported by the Idaho National Engineering Laboratory (INEL), and Los Alamos National Laboratory (LANL) and is sponsored by the United States Nuclear Regulatory Commission (USNRC). The method addresses code minus experimental data differences from scaled facilities and provides a systematic extension of the scaled uncertainty statements to a full scale code application. Conclusions are made relative to the application of the method, interpretation of the results, and method limitations.

13525 **(EGG-M—34686) Analysis of containment venting at the Peach Bottom Atomic Power Station.** Hanson, D.J.; Blackman, H.S.; Nelson, W.R.; Wright, R.E.; Leonard, M.T.; DiSalvo, R. (EG and G Idaho, Inc., Idaho Falls (USA); Battelle Columbus Labs., OH (USA)). 24 Oct 1986. Contract AC07-76ID01570. 20p. (CONF-8610135—45). NTIS, PC A02/MF A01. File Number DE87004538.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

An analysis of the extent to which containment venting would be effective in preventing or mitigating the consequences of severe accidents has been completed for the Peach Bottom Atomic Power Station, Units 2 and 3 (BWR-4s with Mark I containments). The analysis indicates that the effectiveness of venting in preventing containment overpressurization highly depends on the sequence of the severe accident. Containment venting can be effective for several classes of sequences, including transients with failure of long-term decay heat removal and loss-of-coolant accidents with breaks inside the containment. However, based on draft procedures and equipment in place at the time of the evaluation, containment venting has limited potential for further reducing the risk associated with three severe accident sequences currently identified as important risk contributors at Peach Bottom. Means of improving the potential for risk reduction is identified, but their influence on risk is not analyzed.

13526 **(EGG-TMI—7376) TMI-2 radiation monitor data report.** McCormick, R.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1986. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004543.

This is a report on the quality and uncertainty of some of the Health Physics Radiation Monitor data recorded during the TMI-2 accident. The reported data consists of 28 out of a total of 65 channels recorded and were selected mainly through analyst's requests. The radiation rates on all channels were concluded to be trend data and have no attached uncertainties. The time-bases of the recordings were studied in great detail and were categorized as qualified data with corresponding uncertainties attached. All the data reported herein are also contained in the TMI-2 Data Base under the indicated identifiers. Plots of all data are contained in the Appendix. 5 refs., 28 figs., 3 tabs.

13527 **(EGG-TMI—7402) Core relocation in the TMI-2 [Three Mile Island] accident.** Kuan, P. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1986. Contract AC07-76ID01570. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004529.

This report reviews the formation of the debris bed in the TMI-2 nuclear reactor core during the core damage accident on March 28, 1979, and examines plausible thermal and mechanical failure mechanisms of the crust of the consolidated region in the debris bed that allowed molten core material to relocate to the lower plenum of the reactor vessel. Thermal interaction between molten core material and lower core support structures is analyzed. The results are consistent with a sudden failure of the crust and a brief flow of molten core material that caused little, if any, damage to the lower core support structures.

13528 **(EIR—559) Decontamination of a plutonium laboratory after a contamination accident.** Francioni, W.M.; Haenni, F. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Feb 1985. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780501.

On the 24th of May 1983, a minor explosion occurred in a glovebox at the hot laboratories of the Swiss Federal Institute for Reactor Research (EIR). The incident occurred during the evaporation of waste slurries associated with the Institute's mixed carbide fuel program. It resulted in a breaching of the glovebox seals and in heavy contamination of the laboratory housing the box. In this report the problems of decontaminating the laboratory concerned are presented, especially those problems associated with re-contamination during the cleanup process. The experience gained from the decontamination exercise are discussed and details of the costs and resulting quantities of radwaste are also presented. The most important information concerning the incident are also related.

13529 **(EPRI-NP—4941) COBRA-NC code analysis of the Heissdampfreaktor (HDR) containment building following a small steam line break: Final report.** Krotiuk, W.J. (Pacific Northwest Lab., Richland, WA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. Contract AC06-76RL01830. 114p. NTIS, PC A06/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. File Number DE87004110.

COBRA-NC is a digital computer code that simulates the response of multicompartment light water reactor containments, and other buildings to postulated pipe breaks. The code has been used to perform post-test predictions of the response of the German HDR containment to a simulated small steam line break blowdown. Comparisons of calculated compartment transient pressures, and temperatures have been made with experimentally measured values. The COBRA-NC predictions for containment pressure and temperature agree fairly well with the data for about half the analyzed transient of 1200 seconds. The code correctly predicts the presence of vertical temperature stratification, and the flowing of liquid to the bottom of the containment. However, during the second half of the transient, the calculated results for pressure and temperature increase in magnitude instead of decreasing as shown in the measurements. This divergence is attributed to the lack of heat removal at the outside surface of the modeled HDR containment structure. Specifically, the heat transfer connection between the containment structure and the environment outside of the HDR containment is not specified in the supplied description of the HDR facility; thus, in the analyses performed, all outside surfaces of the modeled containment structures are assumed insulated. The agreement between the COBRA-NC predictions and the experimental measurements during the early part of the analyzed transient does provide optimism in the code's ability to predict small break long term temperature stratification and pressure effects in a multicompartment build-

ing, but further work must be performed to verify the code for the prediction of long duration transients.

13530 (EPRI-NP—4972) Application of leak-before-break approach to PWR piping designed by Babcock and Wilcox: Final report. Maxham, W.D.; Yoon, K.K. (Babcock and Wilcox Co., Lynchburg, VA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 105p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920245.

Recently, the leak-before-break (LBB) concept has been used successfully to eliminate some pipe whip restraints, snubbers and jet impingement shields from the primary reactor cooling system piping of pressurized water reactors. This has resulted in substantial savings in maintenance costs, reductions in radiation exposure of plant service personnel, and has enhanced the overall safety of nuclear power plants. This study provides guidelines to utilities in expanding the application of the LBB concept to additional pipe systems and it couples the concept with hardware optimization. Seven high energy piping systems were investigated for technical feasibility in using the LBB concept. The results indicate that some of these seven lines are good candidates for the leak-before-break application.

13531 (GEND-INF—075-Pt.1) TMI-2 core debris grab samples: Examination and analysis: Part 1. Akers, D.W.; Carlson, E.R.; Cook, B.A.; Ploger, S.A.; Carlson, J.O. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1986. Contract AC07-76ID01570. 183p. NTIS, PC A09/MF A01. File Number DE87004546.

Six samples of particulate debris were removed from the TMI-2 core rubble bed during September and October 1983, and five more samples were obtained in March 1984. The samples (up to 174 g each) were obtained at two locations in the core: H8 (center) and E9 (mid-radius). Ten of the eleven samples were examined at the Idaho National Engineering Laboratory to obtain data on the physical and chemical nature of the debris and the postaccident condition of the core. Portions of the samples also were subjected to differential thermal analysis at Rockwell Hanford Operations and metallurgical and chemical examinations at Argonne National Laboratories. This report presents results of the examination of the core debris grab samples, including physical, metallurgical, chemical, and radiochemical analyses. The results indicate that temperatures in the core reached at least 3100 K during the TMI-2 accident, fuel melting and significant mixing of core structural material occurred, and large fractions of some radionuclides (e.g., ^{90}Sr and ^{144}Ce) were retained in the core.

13532 (GEND-INF—075-Pt.2) TMI-2 core debris grab samples: Examination and analysis: Part 2. Akers, D.W.; Carlson, E.R.; Cook, B.A.; Ploger, S.A.; Carlson, J.O. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1986. Contract AC07-76ID01570. 519p. NTIS, PC A22/MF A01. File Number DE87004547.

Six samples of particulate debris were removed from the TMI-2 core rubble bed during September and October 1983, and five more samples were obtained in March 1984. The samples (up to 174 g each) were obtained at two locations in the core: H8 (center) and E9 (mid-radius). Ten of the eleven samples were examined at the Idaho National Engineering Laboratory to obtain data on the physical and chemical nature of the debris and the postaccident condition of the core. Portions of the samples also were subjected to differential thermal analysis at Rockwell Hanford Operations and metallurgical and chemical examinations at Argonne National Laboratories. This report presents results of the examination of the core debris grab samples, including physical, metallurgical, chemical, and radiochemical analyses. The results indicate that temperatures in the core reached at least 3100 K during the TMI-2 accident, fuel melting and significant mixing of core structural material occurred, and large fractions of some radionuclides (e.g., ^{90}Sr and ^{144}Ce) were retained in the core.

13533 (HEDL-SA—3390) Current limitations of trend curve analysis for the prediction of reactor PV embrittlement. Gold, R.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1986. Contract AC06-76FF02170. 42p. (CONF-860605—36). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004435.

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

In operating light water reactor (LWR) commercial power plants, neutron radiation induces embrittlement of the pressure vessel (PV) and its support structures. As a consequence, LWR-PV integrity is a primary safety consideration. LWR-PV integrity is a significant economic consideration since the PV and its support structures are nonreplaceable power plant components and embrittlement of these components can therefore limit the effective operating lifetime of the plant.

13534 (HEDL-SA—3469-FP) FFTF [Fast Flux Test Facility] reactor shutdown system reliability reevaluation. Pierce, B.F. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1986. Contract AC06-76FF02170. 7p. (CONF-860908—37). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004349.

From Operability of nuclear power systems in normal and adverse environments meeting; Albuquerque, NM, USA (29 Sep 1986).

The reliability analysis of the Fast Flux Test Facility reactor shutdown system was reevaluated. Failure information based on five years of plant operating experience was used to verify original reliability numbers or to establish new ones. Also, system modifications made subsequent to performance of the original analysis were incorporated into the reevaluation. Reliability calculations and sensitivity analyses were performed using a commercially available spreadsheet on a personal computer. The spreadsheet was configured so that future failures could be tracked and compared with expected failures. A number of recommendations resulted from the reevaluation including both increased and decreased surveillance intervals. All recommendations were based on meeting or exceeding existing reliability goals. Considerable cost savings will be incurred upon implementation of the recommendations.

13535 (INIS-BR—444) Experimental analysis of upward vertical two-phase flow in four-cusp channels simulating the conditions of a typical nuclear reactor channel, degraded by a loss of coolant accident. Assad, A.C.A. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). 1984. 162p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. File Number DE86780514.

The present work deals with an experimental analysis of upward vertical two-phase flow in channels with circular and four-cusp cross-sections. The latter simulates the conditions of a typical nuclear reactor channel, degraded by a loss of coolant accident. Simultaneous flow of air and water has been employed to simulate adiabatic steam-water flow. The installation of air-water separators helped eliminate instabilities during pressure-drop measurements. The gamma ray attenuation was utilized for the void fraction determination. For the four-cusp geometry, new criteria for two-phase flow regime transitions have been determined, as well as new correlations for pressure drop and void fraction, as function of the Lockhart-Martinelli factor and vapor mass-fraction, respectively.

13536 (INIS-BR—446) Transfer coefficients in a four-cusp duct simulating a typical nuclear reactor channel degraded by accident. de Souza Dutra, A. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). 1985. 113p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780516.

An experimental study on forced convection in a four-cusp duct simulating a typical nuclear reactor channel degraded by accident is presented. Transfer coefficients were obtained by using the analogy between heat and mass transfer, with the naphthalene sublimation technique. The experiment consisted in forcing air past a four-cusp naphthalene molded duct. Mass transfer coefficients were determined in nondimensional form as Sherwood number. Experimental curves correlating the Sherwood number with a nondimen-

sional length, x^+, were obtained for Reynolds number varying from 891 to 30.374. This range covers typical flow rates that are expected to exist in a degraded nuclear reactor core.

13537 (INIS-mf—10100, pp 20) **Fast evaluation of the radiological consequences of possible nuclear accidents.** Feher, I.; Deme, S.; Koblinger, L.; Rosa, G.; Ronaky, J. (Hungarian Academy of Sciences, Budapest; Paks Nuclear Power Station, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13538 (INIS-mf—10100, pp 21) **Approximations to evaluate the external dose integral for reactor accidents.** Szabo, Z.; Kerekes, A.; Kanyar, B. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13539 (INIS-mf—10100, pp 17) **Computer technics in corrosion product activation research for shut-down dose reduction at Paks NPP.** Horvath, G.L.; Ormai, P.; Pinter, T.; Szabo, I.C.; Radnai, T. (Institute for Electrical Power Research, VEIKI, Budapest, Hungary; Paks N.P.P., Hungary; Central Research Institute for Chemistry, KKKI, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13540 **(LA—10890-MS) TA-2 water boiler reactor decommissioning (Phase 1).** Elder, J.C.; Knoell, C.L. (Los Alamos National Lab., NM (USA)). Dec 1986. Contract W-7405-ENG-36. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004761.

Removal of external structures and underground piping associated with the gaseous effluent (stack) line from the TA-2 Water Boiler Reactor was performed as Phase I of reactor decommissioning. Six concrete structures were dismantled and 435 ft of contaminated underground piping was removed. Extensive soil contamination by ^{137}Cs was encountered around structure TA-2-48 and in a suspected leach field near the stream flowing through Los Alamos Canyon. Efforts to remove all contaminated soil were hampered by infiltrating ground water and heavy rains. Methods, cleanup guidelines, and ALARA decisions used to successfully restore the area are described. The cost of the project was approximately $320K; 970 m^3 of low-level solid radioactive waste resulted from the cleanup operations.

13541 **(NUREG/CR—4222) Analyses of plume formation, aerosol agglomeration and rainout following containment failure.** Leigh, C.D.; Spulak, R.G. Jr.; Williams, D.C.; Boughton, B.D.; Richards, C.N.; Dunn, W.E. (Sandia National Labs., Albuquerque, NM (USA); Atmospheric Physics, Inc., Peralta, NM (USA); Illinois Univ., Urbana (USA)). Aug 1986. Contract AC04-76DP00789. 169p. (SAND—84-2581). NTIS, PC A08/MF A01 - GPO. File Number TI87003109.

This report gives the results of a two-year study of steam condensation in the volume of gases released from the containment building during a severe reactor accident. Steam condensation effects outside the containment building are not currently included in any ex-plant consequence studies and are not quantified in other studies.

13542 **(NUREG/CR—4567) Once-through integral system (OTIS): Final report.** Gloudemans, J.R. (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research Center). Sep 1986. 607p. (EPRI-NP—4572; BAW—1905). NTIS, PC E19/MF $12.10 - GPO. File Number TI87900169.

Includes 19 sheets of 24x reduction microfiche.

A scaled experimental facility, designated the once-through integral system (OTIS), was used to acquire post-small break loss-of-coolant accident (SBLOCA) data for benchmarking system codes. OTIS was also used to investigate the application of the Abnormal Transient Operating Guidelines (ATOG) used in the Babcock and Wilcox (B and W) designed nuclear steam supply system (NSSS) during the course of an SBLOCA. OTIS was a single-loop facility with a plant to model power scale factor of 1686. OTIS maintained the key elevations, approximate component volumes, and loop flow resistances, and simulated the major component phenomena of a B and W raised-loop nuclear plant. A test matrix consisting of 15 tests divided into four categories was performed. The largest group contained 10 tests and was defined to parametrically obtain an extensive set of plant-typical experimental data for code benchmarking. Parameters such as leak size, leak location, and high-pressure injection (HPI) shut-off head were individually varied. The remaining categories were specified to study the impact of the ATOGs (2 tests), to note the effect of guard heater operation on observed phenomena (2 tests), and to provide a data set for comparison with previous test experience (1 test). A summary of the test results and a detailed discussion of Test 220100 is presented. Test 220100 was the nominal or reference test for the parametric studies. This test was performed with a scaled 10-cm^2 leak located in the cold leg suction piping.

13543 **(NUREG/CR—4616) Root Causes of Component Failures Program: Methods and applications.** Satterwhite, D.G.; Cadwallader, L.C.; Vesely, W.E.; Meale, B.M. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Risk Analysis and Operations). Dec 1986. Contract AC07-76ID01570. 57p. (EGG—2455). NTIS, PC E05/MF A01 - GPO. File Number TI87004461.

Includes 2 sheets of 24x reduction microfiche.

This report contains information pertaining to definitions, methodologies, and applications of root cause analysis. Of specific interest, and highlighted throughout the discussion, are applications pertaining to current and future Nuclear Regulatory Commission (NRC) light water reactor safety programs. These applications are discussed in view of addressing specific program issues under NRC consideration and reflect current root cause analysis capabilities.

13544 **(NUREG/CR—4672) Analysis of instrument tube ruptures in Westinghouse 4-loop pressurized water reactors.** Fletcher, C.D.; Bolander, M.A. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Systems Safety). Dec 1986. Contract AC07-76ID01570. 45p. (EGG—2461). NTIS, PC A03/MF A01 - GPO. File Number TI87004485.

A recent safety concern for Westinghouse 4-loop pressurized water reactors (PWRs) is that, because of a seismic event, instrument tubes may be broken at the flux mapping seal table, resulting in an uncovering and heatup of the reactor core. This study's purpose was to determine the effects upon findings of a similar 1980 study if certain test variables changed. A 1980 US Nuclear Regulatory Commission (USNRC) analysis of PWR behavior used the RELAP4/MOD7 computer code to determine the effects of breaking instrument tubes at the reactor vessel lower plenum wall. The 1986 study discussed here was performed using RELAP5/MOD2, an advanced best-estimate computer code. Separate effects analyses investigated instrument tube pressure loss, heat loss, and tube nodalization effects on break flow. Systems effects analyses: (1) investigated the effects of changing the break location from the reactor vessel to the seal table, (2) compared RELAP4/MOD7 and RELAP5/MOD2 results for an identical transient, (3) verified a key finding from the 1980 analysis, and (4) investigated instrument tube ruptures in the Zion-1 PWR using best-estimate boundary and initial conditions. The outcome of these analyses permits adjustment

of the 1980 analysis findings for instrument tube ruptures at the seal table and indicates the best-estimate response of a Washington PWR to the rupture of 25 small instrument tubes at the seal table.

13545 **(NUREG/CR—4734) Seismic testing of typical containment piping penetration systems.** Close, J.A.; Hill, R.C.; Steele, R. Jr. (EG and G Idaho, Inc., Idaho Falls (USA); Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering Safety). Dec 1986. Contract AC07-76ID01570. 38p. (EGG—2470). NTIS, PC A03/MF A01 - GPO. File Number TI87004463.

This report provides the results of seismic tests of three typical light water reactor containment penetration systems to provide a technical basis for the support and development of equipment qualification procedures. The three systems tested were: (1) An eight-inch gate valve system modeling a containment spray system; (2) An eight-inch butterfly valve system modeling a purge and vent system; and (3) A two-inch globe valve system modeling the numerous small bore piping systems that are often characterized by high valve to pipe size ratio. The valve types, sizes, piping configurations, penetrations and supports used for the tests are typical of those found in commercial US nuclear power plants for containment isolation applications. The three systems tested were mounted in a fixture and excited with simulated seismic loads. The loads imposed during the tests were equal or greater than those expected during US operating-basis and safe-shutdown earthquakes. The test results indicate that adverse valve, penetration, or piping system behavior during typical seismic events is very unlikely.

13546 **(NUREG/CR—4792-Vol.4) Probability of failure in BWR reactor coolant piping: Guillotine break indirectly induced by earthquakes.** Hardy, G.S.; Campbell, R.D.; Ravindra, M.K. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; NTS/ Structural Mechanics Associates, Newport Beach, CA (USA); Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 121p. (UCID—20914-Vol.4). NTIS, PC A06/MF A01 - GPO. File Number TI87004262.

The requirements to design nuclear power plants for the effects of an instantaneous double-ended guillotine break (DEGB) of the reactor coolant piping have led to excessive design costs, interference with normal plant operation and maintenance, and unnecessary radiation exposure of plant maintenance personnel. This report describes an aspect of the NRC/Lawrence Livermore National laboratory-sponsored research program aimed at investigating whether the probability of DEGB in Reactor Coolant Loop Piping of nuclear power plants is acceptably small such that the requirements to design for the DEGB effects (e.g., provision of pipe whip restraints) may be removed. This study estimates the probability of indirect DEGB in Reactor Coolant piping as a consequence of seismic-induced structural failures within the containment of the GE supplied boiling water reactor at the Brunswick nuclear power plant. The median probability of indirect DEGB was estimated to be 2×10^{-8} per year. Using conservation assumptions, the 90% subjective probability value (confidence) of P/sub DEGB/ was found to be less than 5×10^{-7} per year.

13547 **(SAND—86-2119C) Integrated ex-vessel source term analysis with the CONTAIN 1.1 computer code.** Murata, K.K.; Schelling, F.J.; Valdez, G.D.; Carroll, D.E.; Washington, K.E. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 15p. (CONF-8610135—44). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004240.

From 14. water reactor safety information meeting; Gaithersburg, MD, USA (27 Oct 1986).

Important new phenomenological models and code improvements, which will be available in Version 1.1 of the CONTAIN code, are discussed, and results of a thirteen cell demonstration calculation presented. CONTAIN has been developed for the USNRC as a best-estimate code for modeling nuclear reactor containment behavior under severe accident conditions. CONTAIN 1.1 has major new capabilities for treating core-concrete interactions and boiling water reactor (BWR) containment systems. The CORCON and VANESA codes have been merged with CONTAIN for modeling the behavior of molten core interactions with concrete, and suppression pool models have been developed for use in BWR containment calculations. Significant improvements made to existing models of radiation heat transfer, pool boiling, fission product transport, and aerosol flow are also discussed. Calculational results for a BWR station blackout accident sequence illustrate the wide range of coupled physical phenomena that CONTAIN can model.

13548 **(SAND—86-2678C) Radionuclide release and aerosol generation during core debris interactions with concrete.** Powers, D.A.; Brockmann, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 37p. (CONF-860911—22). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003039.

From 192. American Chemical Society national meeting; Anaheim, CA, USA (7 Sep 1986).

The VANESA model predicts the release of radionuclides and generation of aerosols associated with core debris interactions with concrete during severe reactor accidents. The technical bases for the VANESA model are described. Some comparisons of the model predictions to the results of high temperature melt/concrete interaction tests are shown. These results show the VANESA model predictions are in good agreement with the limited amount of available experimental data. The VANESA model has been applied to numerous severe accident analyses. In general, the model predicts aerosol production during core debris/concrete interactions lasts far longer than was previously supposed. It is also found that releases of radionuclides during the interactions are quite dependent on the specific features of the plant and accident in question. Both the extent of release and the timing of release of tellurium and refractory radionuclides can be quite different than was predicted by earlier, supposedly bounding, models. Another important finding from the VANESA model is that water overlying core debris attacking concrete can attenuate significantly the emission of both radioactive and non-radioactive aerosols.

13549 **(SRD-R—358) The evolution of fission gas from overheated UO_2.** MacInnes, D.A.; Gittus, J.H. (UKAEA Safety and Reliability Directorate, Culcheth). Apr 1986. 15p. (CONF-850809—85). UKAEA, Wigshaw Lane, Culcheth Warrington, WA3 4NE. File Number TI87900229.

From 8. international conference on structural mechanics in reactor technology; Brussels, Belgium (19 Aug 1985).

We review recent developments in the theory of intragranular fission product evolution. These are incorporated in the SINGAR model developed at SRD in order to analyze fission gas evolution in UO_2 undergoing transient heating. The rate-controlling process in this model is thermal resolution of gas atoms from intragranular bubbles together with migration of single atoms to grain boundaries. We briefly discuss the limitations of this description with particular emphasis on current and future research activity. The principal reason for our interest in this modelling is to develop the capability to predict the likely clad damage resulting from fission-product-driven fuel swelling and pellet-clad interaction if fuel overheats. We review the main problems in this area.

13550 **Steam-water critical flow through small pipes from stratified upstream regions.** Schrock, V.E.; Revankar, S.T.; Mannheimer, R.; Wang, C.H.; Jia, D. (Dept. of Nuclear Engineering and Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 2307-2312 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

Discharge of fluid through a small pipe connected to a large horizontal pipe containing stratified fluid is of concern in reactor safety evaluations. This paper presents the results of an experimental investigation into the levels associated with incipient vapor pull-through and liquid entrainment for branches oriented at the top, side and bottom of the horizontal pipe and into the steam quality entering the break after the onset of entrainment of the second phase. The main pipe was 102 mm in diameter and the break tubes were 4, 6, and 10 mm in diameter and 123 mm in length. Both air-water and steam-water were used at pressures up to 1.07 MPa. In-

cipient data, together with data from other studies, are correlated in terms of Froude number, Bond number and viscosity number for submerged breaks and in terms of Froude number alone for liquid entrainment. Quality correlations are presented and discussed in the context of the critical flow calculation for a small break LOCA.

13551 **Core thermal response and mass distribution during vessel mass depletion associated with a SBLOCA.** Loomis, G.G. (Idaho National Engineering Lab., Idaho Falls, ID). pp 2523-2528 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

Experimental results are presented involving core thermal-hydraulic response during a small break loss-of-coolant accident (SBLOCA) simulation performed in the Semiscale Mod-2C facility. The experiments were performed at high temperatures and pressures with initial conditions typical of a pressurized water reactor (15.6 MPa pressure; 600 K hot leg fluid temperature). The Mod-2C facility represents the state-of-the-art in measurement of in-core average channel fluid density at several elevations which allows an estimate of the axial void fraction distribution during the transient. The void fraction distribution is quantified for two major liquid level depressions associated with SBLOCA response. The first level depression was relatively rapid (25 s) and had multi-dimensional heatup effects which suggest falling films of liquid on the rod surface. The second level depletion with a much slower rate (250 s) had no multidimensional effects (an orderly top-down heatup of rod positions was observed).

25 ENERGY STORAGE

2503 Pumped Hydro

13552 **(EPRI-EM—4599-Vol.2) Ultrahigh head pump/turbine development program: Volume 2, Advanced design, hydraulic and mechanical: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 244p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920204.

This report presents details of the process and the results of Task 2, Advanced Design. This task includes all the theoretical studies, detailed designs of components, and evaluations of method and materials that result in a complete ready-to-build design. The design drawings and assessments of manufacturability and reliability are included.

13553 **(EPRI-EM—4599-Vol.3) Ultrahigh head pump/turbine development program: Volume 3, Advanced design: Static stress analysis, main components: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 159p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920205.

This report concerns the progress of the stress and deformation analyses made during the period from August to December, 1982. The structure designed in the early period of Task 2 was used for the analyses. Analyses are made for the major components; the top stage runner, the wicket gates, the return guide, the spiral casing and speed ring, the head cover and the bottom cover.

13554 **(EPRI-EM—4599-Vol.4) Ultrahigh head pump/turbine development program: Volume 4, Advanced design: Strength manufacturability, controls, and reliability: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 399p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920206.

The commercial availability of an ultrahigh head pump/turbine whose output can be regulated makes underground and ultra-high head-pumped storage creditable options for utility use by reducing construction costs and plant complexity. This new turbine operates at double the head of existing equipment yet uses commercial materials, proven design concepts, and manageable manufacturing techniques. This volume discusses the stress analysis and fatigue evaluation, manufacturability, control system, and reliability and maintainability analyses.

13555 **(EPRI-EM—4599-Vol.5) Ultrahigh head pump/turbine development program: Volume 5, Model tests: Basic performance: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 287p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920207.

Pump/turbine model tests for the Ultra-High Head Pump/Turbine Development Program were conducted for evaluating and refining the pump/turbine design, rated speed 720 rpm, net head 1450, output 655 MW on the scale model at Hitachi Hydraulic Research Laboratory. The basic testing resulted in verification of the design, analysis, and performance of the high head pump/turbine.

13556 **(EPRI-EM—4599-Vol.6) Ultrahigh head pump/turbine development program: Volume 6, Model tests: Special performance: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 364p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920208.

The model pump/turbine was supplied not only for the basic hydraulic performance tests but also various special tests which inform important data utilized for designing mechanical components and analyzing hydraulic transient. The special tests carried out in this program contains four quadrant characteristics, hydraulic thrust(axial), wicket gate torque, radial thrust, air supply and exhaust, and velocity distribution. This volume contains the report of witness tests performed both for the basic hydraulic performance test and the special tests.

13557 **(EPRI-EM—4599-Vol.7) Ultrahigh head pump/turbine development program: Volume 7, Analysis of hydraulic transients: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 143p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920209.

This report describes the review of the hydraulic transients with respect to load/input rejections at the underground pumped storage plant with two-stage reversible pump/turbines. The maximum penstock pressure due to load and/or input rejection is the largest pressure that acts on the penstocks in most cases and, hence, constitutes the design pressure for the civil structures. The overspeed due to load rejection is the fastest speed that the rotor actually undergoes during normal operations, exclusive of accidents, and, thereby, constitutes the basis for the fatigue strength evaluation of pump/turbine runners.

13558 **(EPRI-EM—4599-Vol.8) Ultrahigh head pump/turbine development program: Volume 8, Confirmatory testing plan: Final report.** Yokoyama, T. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works; Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 78p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920210.

This report concerns the studies made in Task 6, "Confirmatory Model Testing Plan and Procedure." This task reviews the entire design and testing development program of the two-stage pump/turbine. Task 6 is aimed at evaluating whatever additional work is required to demonstrate and verify to the utilities the reliability and actual performance of the developed machine. Purpose of this entire program is to provide the utilities with the best available technological and practical design for a trouble free two-stage pump/turbine. The following three plans are proposed and studied to further confirm the reliability and performance of the prototype pump/turbine: construction of pilot machine; actual head test in laboratory; and component tests in shop.

2506 Thermal

13559 (AD-A—173719/6/XAB) Thermal aspects of future spacecraft thermal management systems. Interim report, 1 January 1984-1 October 1985. Sheffield, J.W.; Kher, R.P. (Missouri Univ., Rolla (USA). Dept. of Mechanical and Aerospace Engineering). Jul 1986. 78p. NTIS, PC A05/MF A01.

This report addresses the conceptual design of spacecraft thermal management systems (SCTMS) and their components to provide a basis for the development and implementation of future technologies. In the analysis, components of the SCTMS include: heat pipes, latent thermal energy storage materials, radiators, and other thermal structures. The design problem becomes one of selecting a combination of these components subject to both spacecraft mission and launch requirements. To assist in this design process, a knowledge-based software was developed in the artificial intelligence programming language, PROLOG. This software serves as a design assistant for the development of SCTMS. It supports facilities such as data-base retrieval, numerical computation, and logical decision making. With these features one can automatically consider all relevant combinations of components, technologies, and materials for the design problem. The goal has been to duplicate, wherever possible, the decision processes of an experienced designer by putting significant decision making, search, and retrieval facilities at his or her disposal. Other objectives were to determine the capabilities of the phase-change materials (PCMs) selected by the knowledge-based system. Tests were carried to evaluate properties and thermal behavior of a PCM in pellet form. Two types of PCMs demonstrated potential for SCTMS were calcium chloride hexahydrate and the form stable crystalline polymer, high density polyethylene.

2509 Batteries

13560 (AD-A—173984/6/XAB) Electrochemical preparation of polymer electrodes. Final report, 19 August 1985-18 August 1986. Foos, J.S.; Erker, S.M.; Liberto, M.C. (EIC Labs., Inc., Norwood, MA (USA)). 18 Oct 1986. 4p. NTIS, PC A02/MF A01.

Polymer electrolytes formed by the chemical and electrochemical polymerization of a solution of $LiAsF_6$ in dioxolane were examined. The liquid electrolyte was stabilized by preparing and storing it in the presence of Li metal as a proton and carbocation scavenger. The initial results show that the polymerization of the electrolyte is readily initiated chemically by acids or oxidizing agents. The polymerization continues so that over 24 hrs at room temperature, the conductivity of the resulting polymer electrolyte decreases to near .000001 S/cm. Subsequent work involved the prparation of free-standing films and TiS_2 electrodes containing the polymer electrolyte. Lithium/TiS_2 cells were constructed and evaluated at room temperature and 60 C.

13561 (AD-A—174577/7/XAB) Safety characteristics of non-lithium battery systems. Revision 1. Final report, October 1983-September 1984. Murphy, R.M.; Bis, R.F. (Advanced Battery Group, Lancaster, NY (USA)). Jul 1986. 297p. NTIS, PC A13/MF A01.

A study was conducted to determine the safety characteristics for both primary and secondary non-lithium battery systems. Of particular interest was the behavior of these battery systems when subjected to the electrical and thermal abuse testing procedures (i.e., short circuit, forced overdischarge, and incineration). Also included are the safety/hazard characteristics associated with charging primary batteries and overdischarging secondary batteries. This report also summarizes the manufacture, electrical performance, failure mechanisms, self-discharge, and applications for twenty-two primary and nineteen secondary battery systems.

13562 (ANL—86-40) Proceedings of the international workshop on high-temperature molten salt batteries. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 239p. (CONF-8604116—). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE87003297.

From International workshop on high temperature molten salt batteries; Argonne, IL, USA (16 Apr 1986).

Twenty-six papers are presented in three sessions, titled: basic properties of molten salt battery systems, engineering development of lithium-alloy/metal sulfide batteries; and research and development in molten salt systems. Individual papers are abstracted separately for the data base. (DLC)

13563 (EPRI-AP—4982) Battery Energy Storage Test (BEST) Facility: Summary report, 1976-1986: Final report. Hyman, E.A. (Public Service Electric and Gas Co., Newark, NJ (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. Contract AC02-76ET29368. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004785.

This report summarizes the development, operations, and contributions of the Battery Energy Storage Test Facility. Providing direction for the nation's battery technology research, the facility has generated a better understanding of the work involved in operating energy storage systems and has been instrumental in demonstrating lead-acid battery applications for utilities worldwide.

13564 (EPRI-EM—4701) Evaluation of near-term electric vehicle battery systems through in-vehicle testing: Interim report. Blickwedel, T.W. (Tennessee Valley Authority, Chattanooga (USA). Transportation Projects; Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 146p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920173.

EVTF personnel tested 10 batteries, including lead-acid (flat plate and tubular design), Gel Cell III, advanced lead-acid, nickel iron, nickel zinc, nickel cadmium, and zinc chloride systems. The assessment encompassed the following tasks: initial acceptance testing of battery components and systems, daily in-vehicle operation of the batteries, monthly in-vehicle driving range tests, and periodic static discharge tests under computer control. Performance data were based on specific energy versus accumulated vehicle mileage and vehicle driving range over a fixed operating cycle at 35-mph constant speed and the SAE J227a C cycle. A battery's life cycle was terminated when its measured capacity dropped below 60% of the rating, at a 2-h rate, after 25% of the battery modules had been replaced. The EVs used for the tests were 10 Volkswagen vans and 2 General Motors Griffin vans.

13565 (N—86-31680) Mathematical approach for evaluating nickel-hydrogen cells. Leibecki, H.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 18p. (NASA-TM—88803; E—3114; NAS—1.15:88803). NTIS HC A02/MF A01.

From 1986 Fall annual meeting of the AIChE; Miami, FL, USA (2 Nov 1986).

A mathematical equation is presented which gives a quantitative relationship between time-voltage discharge curves, when a cell's ampere-hour capacity is determined at a constant discharge current. In particular the equation quantifies the initial exponential voltage decay; the rate of voltage decay; the overall voltage shift of the curve and the total capacity of the cell at the given discharge current. The results of 12 nickel-hydrogen boiler plate cells cycled to 80 percent depth-of-discharge (DOD) are discussed in association with these equations.

13566 (N—86-31979) Parametric and cycle tests of a 40-A-hr bipolar nickel-hydrogen battery. Cataldo, R.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 12p. (NASA-TM—88793; E—3102; NAS—1.15:88793; CONF-860810—42). NTIS HC A02/MF A01.

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

A series of tests was performed to characterize battery performance relating to certain operating parameters which included charge current, discharge current, temperature and pressure. The parameters were varied to confirm battery design concepts and to determine optimal operating conditions. Spacecraft power requirements are constantly increasing. Special spacecraft such as the Space Station and platforms will require energy storage systems of 130 and 25 kWh, respectively. The complexity of these high power

systems will demand high reliability, and reduced mass and volume. A system that uses batteries for storage will require a cell count in excess of 400 units. These cell units must then be assembled into several batteries with over 100 cells in a series connected string. In an attempt to simplify the construction of conventional cells and batteries, the NASA Lewis Research Center battery systems group initiated work on a nickel-hydrogen battery in a bipolar configuration in early 1981. Features of the battery with this bipolar construction show promise in improving both volumetric and gravimetric energy densities as well as thermal management. Bipolar construction allows cooling in closer proximity to the cell components, thus heat removal can be accomplished at a higher rejection temperature than conventional cell designs. Also, higher current densities are achievable because of low cell impedance. Lower cell impedance is achieved via current flow perpendicular to the electrode face, thus reducing voltage drops in the electrode grid and electrode terminals tabs.

13567 **(N—86-31980) Effect of impregnation method on cycle life of the nickel electrode.** Smithrick, J.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 9p. (NASA-TM—87326; E—3037; NAS—1.15:87326; CONF-860810—43). NTIS HC A02/MF A01.

From Intersociety energy conversion engineering conference; San Diego, CA, USA (25 Aug 1986).

The nickel electrode has been identified as the life limiting component for individual pressure vessel (IPV) nickel-hydrogen cells when cycled under a low earth orbit (LEO) cycle regime at deep depths of discharge. As a part of an overall program to develop a long life nickel electrode for nickel-hydrogen cells, the effect of two different methods of electrochemical impregnation on the cycle life of the nickel electrode was investigated. One method was the Pickett (aqueous/ethanolic) process. The other was the modified Bell (aqueous) process. The plaques for both impregnation methods were made by sintering dry carbonyl nickel powder in a reducing atmosphere. The plaques contain a nickel screen substrate. Electrodes made from both processes were cycle tested in Air Force design IPV nickel-hydrogen cells. The only factor different for this test was the method of plaque impregnation; all other factors were the same. The cells were cycled to failure under a 90 min LEO cycle regime at a deep depth of discharge (80 percent DOD). Failure for this test was defined to occur when the cell voltage degraded to 1.0 V prior to the completion of the 35 min discharge.

13568 **(N—86-31981) Design considerations for advanced battery concepts.** Leibecki, H.F.; Thaller, L.H. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 16p. (NASA-TM—87319; E—3055; NAS—1.15:87319; CONF-8606220—1). NTIS HC A02/MF A01.

From American Institute of Aeronautics and Astronautics meeting on space systems technology; San Diego, CA, USA (9 Jun 1986).

A mathematical representation for the charge and discharge of a sodium-sulfur cell is developed. These equations are then used as the basis for a computerized model to examine the effects of cell arrangement in the design of a large multi-kilowatt battery from a group of hypothetical individual cells with known variations in their ampere hour capacity and internal resistance. The cycling characteristics of 216 individual cells arranged in six different configurations are evaluated with the view towards minimizing the adverse effects that are introduced due to the stoichastic aspects of groupings of cells, as well as the possibility of cell failures in both the open and shorted mode. Although battery systems based on sodium-sulfur cells are described in this example, any of the newer electrochemical systems can be fitted into this framework by making appropriate modifications to the basic equations.

13569 **(N—87-11072) 1985 Goddard Space Flight Center Battery Workshop.** Morrow, G. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Sep 1986. 427p. (NASA-CP—2434; REPT—86B0366; NAS—1.55:2434; CONF-8511255—). NTIS, PC A19/MF A01.

From Goodard Space Flight Center battery workshop; Greenbelt, MD, USA (19 Nov 1985).

The subjects covered include: advanced energy storage, lithium cell technology, nickel-cadmium design evaluation and component testing, simulated orbital cycling and flight experience, and nickel-hydrogen technology.

13570 **(PB—87-116349/XAB) Halogen compounds as positive electrodes in nonaqueous or aqueous batteries.** Rupich, M.W. (EIC Labs., Inc., Norwood, MA (USA)). Aug 1984. 37p. NTIS, PC A03/MF A01.

Electron donor-accepted complexes between bromine and iodine and hexamethylenetetraamine were prepared and evaluated as potential cathode materials in a metal/halogen cell. An initial evaluation of the complexes as electrode materials showed they can be discharged at high potentials in either aqueous or nonaqueous electrolytes. It was also demonstrated that the complexes can be regenerated during charge, allowing their use in secondary batteries. Preliminary results demonstrate that it is feasible to immobilize the complexes on the cathode by attaching them to an insoluble polymer. The results of the program indicate that the electron donor-acceptor complexes have the potential for widespread application in both aqueous or nonaqueous batteries.

13571 **Electrocatalytic reactivity of hydrocarbons on a zirconia electrolyte surface.** Nguyen, B.C.; Lin, T.A.; Mason, D.M. (Dept. of Chemical Engineering, Stanford Univ., Stanford, CA 94305). *Journal of the Electrochemical Society;* **133**: No. 9, 1807-1814(Sep 1986).

An experimental survey of the electrochemical reactivity of five common fuel species was made employing a solid oxide electrolyte galvanic cell with porous Au and Pt electrodes in the temperature range 700°-850°C. The electrolyte used was Sc/sub 2/O/sub 3/-stabilized ZrO/sub 2/(SSZ). The fuel species electro-oxidized at the anode were: H/sub 2/ CO, CH/sub 4/, CH/sub 3/OH, and C/sub 2/H/sub 5/OH. Rates of reaction were determined coulometrically so that species other than H/sub 2/ could have undergone an undetermined amount of thermal dissociation during electro-oxidation. The concomitant reactivity of O/sub 2/, which is reduced at the cathode, was also investigated. The current-overpotential behavior at both the cathode and anode was found to be similar whether Au or Pt was used to form the porous electrodes. In the low overpotential range, the rate of charge transfer is found to be rate determining for both the cathodic and anodic reactions.

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 13604, 13610, 13660

13572 **(EUR—8896-2) Energy supply Modelling Package EFOM-12C Mark I User's guide.** Van der Voort, E.; Donni, E; Thonet, C.; Bois d'Enghien, E.; Dechamps, C.; Guilmot, J.F. (Commission of the European Communities, Luxembourg). 1985. 661p. Commission of the European Communities, Luxembourg.

The Efom-12C model is a technico-economic supply model that simulates or optimizes the primary energy requirements and the related investments in energy production and consumption necessary in order to satisfy a given exogenous demand of useful or final energy. The main features of this energy supply model are the following: (I) The technico-economic information is stored in a data base designed to allow the user to build modular structures out of an energy system from the very large representation of national systems to more specific subclasses of the energy sector. (II) Two operation modes are provided - simulation and optimization - which can be used alternatively on any earlier defined structure. The detailed lay-out of the Mark-I version of this model is the object of this report. Part I covers the complete mathematical description of the model and the variety of its technical possibilities. Part II instructs the potential user of this model on how to utilize the accompanying software package to treat the problem he has in mind. Finally, Part III addresses itself to programmers when software modifications or upgradings would be necessary. Specific case studies that were carried out with the Efom-12C model by the services of

the CEC and by energy research and planning groups in the Member States as well as in Spain and in Portugal are reported elsewhere in referenced publications.

13573 **(EUR—8896-3) Energy supply Modelling Package EFOM-12C Mark I Programmer's guide.** Van der Voort, E.; Donni, E.; Thonet, C.; Bois d'Enghien, E.; Dechamps, C.; Guilmot, J.F. (Commission of the European Communities, Luxembourg). 1985. 186p. Commission of the European Communities, Luxembourg.

The Efom-12C model is a technico-economic supply model that simulates or optimizes the primary energy requirements and the related investments in energy production and consumption necessary in order to satisfy a given exogenous demand of useful or final energy. The main features of this energy supply model are the following: (I) The technico-economic information is stored in a data base designed to allow the user to build modular structures out of an energy system from the very large representation of national systems to more specific subclasses of the energy sector. (II) Two operation modes are provided - simulation and optimization - which can be used alternatively on any earlier defined structure. The detailed lay-out of the Mark-I version of this model is the object of this report. Part I covers the complete mathematical description of the model and the variety of its technical possibilities. Part II instructs the potential user of this model on how to utilize the accompanying software package to treat the problem he has in mind. Finally, Part III addresses itself to programmers when software modifications or upgradings would be necessary. Specific case studies that were carried out with the Efom-12C model by the services of the CEC and by energy research and planning groups in the Member States as well as in Spain and in Portugal are reported elsewhere in referenced publications.

13574 **(EUR—9175) Study of the effectiveness of decomposition algorithms in resolving linear problems generated by ORESTE.** Berger, C. (Commission of the European Communities, Luxembourg). 1984. 85p. (In French). Commission of the European Communities, Luxembourg.

The structure of the constraint matrix of the multiregional multiperiod energy flow models has been recognized for a long time. Two codes using decomposition techniques have been constructed on the basis of MPSX/370: DECOMPSX exploits the multiregional structure, while LIFT takes advantage of its multiperiod properties. This report considers different energy flow models of the EFOM 12C type that exhibit both structures and treats them by LIFT and DECOMPSX. Numerical experience is reported with models of up to 6000 constraints; reformulations of the coupling constraints are also discussed.

13575 **(EUR—9696) MEDEE-3B model.** Funck, B. (Commission of the European Communities, Luxembourg). 1985. 120p. (In French). Commission of the European Communities, Luxembourg.

This report contains a description of the MEDEE 3 model (Part 1) and a synthesis of a first group of simulations with the Belgian version of the model (Part 2 and 3). In the first part, MEDEE 3 is presented as a long term simulation model of energy demand. It is based on a technico-economic approach of the energy system which is described in a very desaggregated way. A first simulation was realised for Belgium. This application took place in the context of a more general activity of the EEC which is known as "Energy Scenarios 2000". Three different scenarios were tested. They are presented in the second part while the results appear in the third part of the report. One of the main features of these results is the stabilisation of energy demand after 1985. In none of the result scenarios does energy demand reach the levels of 1980.

13576 **(EUR—9697) Spanish MEDEE-3 model: establishment of the data base.** (Commission of the European Communities, Luxembourg). 1985. 116p. (In French). Commission of the European Communities, Luxembourg.

This report constitutes the work executed for the elaboration of the data base in the framework of the long-term energy demand model development for Spain (MEDEE-3). The literature references which enabled direct entry of data are quoted. They justified the calculations undertaken in other cases for obtaining acceptable standards for the data bank of the model. For the estimations of the Spanish model the work could be divided according to the following sub-models: households, lodging, heating, hot-water, cooking, specific electricity, tertiary, transport of persons, transport of goods, economic structure, light industry, large energy consuming industries, agriculture, buildings, and public works.

13577 **(FRNC-TH—2240) Models IMPACT 1 and IMPACT 2: observed limits in their utilization for comparing very long term energy strategies economic effects.** Launay, D. (Grenoble-1 Univ., 38 (France)). 1983. 136p. (In French). NTIS (US Sales Only), PC A07. File Number DE87750949.

The aim of this thesis was to develop long term energetic strategies and analyze them using the mathematical model IMPACT 1. This model is based on a dynamized Leontief model input-output methodology. Meanwhile, the model IMPACT 1, applied to a global world energetic system, does not control the gross national product. So a second model, IMPACT 2 was developed and allowed to examin the various schemes of final energy consumption and energetic economies. Inadequation of these two models, but also of any models for a correct and satisfying evaluation of prices and energy costs evolution as a function of technology is demonstrated with an application of the models to the German Federal Republic example.

13578 **(WMO—52, pp vp) Energy related issues.** Page, J.K. 1986. NTIS MF A01; print copy available at WMO, Geneva, Switzerland. (ETN—86-97658).

In Proceedings of the Technical Conference on Urban Climatology and its Applications with Special Regard to Tropical Areas.

The patterns of energy consumption in tropical cities are examined in order to assess the potential contributions of energy issues to city planning. Bioclimatic analysis in urban energy studies, energy analysis of urban climates, natural climatic resources available to reduce fossil fuel demand, climatic planning, seasonal storage of coolness, transportation and energy use, and techniques of urban climatic energy analysis are treated. It is shown that significant energy savings and increased comfort can be achieved by climatic planning.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 13598

13579 **(DOE/EIA—0466(85)) Profiles of foreign direct investment in US energy, 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 9 Jan 1987. 48p. NTIS, PC A03/MF A01 - GPO; 1; GPO Dep. File Number DE87004339.

In accordance with Section 657, Subpart 8, of the Department of Energy Organization Act, the Energy Information Administration (EIA) prepares an annual report for the Secretary of Energy and for transmittal to Congress. This report summarizes the activation in the United States by foreign-affiliated companies that own or control US energy sources and supplies. Presented in this report, for 1985, are profiles of foreign direct investment in US petroleum (including natural gas production); foreign-affiliated companies' energy production, processing, distribution, and reserves; and foreign-affiliated energy companies' financial performance and investment activity in 1985. Additionally, profiles of US companies' energy operations abroad and comparisons of foreign-affiliated companies to US energy companies are presented. The information is intended for use by the Congress, government agencies, energy industry analysts, international trade and finance analysts, and the public.

13580 **(PB—87-140588/XAB) DOE/NBS (Department of Energy/National Bureau of Standards) forum on testing and rating procedures for consumer products, October 2-3, 1985. Final report.** Dikkers, R.D. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Jul 1986. 68p. (NBSIR—86/3412). NTIS, PC A04/MF A01.

One hundred thirty-four persons participated in a Forum on Testing and Rating Procedures for Consumer Products held at the National Bureau of Standards (NBS), Gaithersburg, Maryland, on October 2-3, 1985. The objectives of the forum, planned in cooperation with various industry associations, were: (1) to provide a line of communication between test procedure users and test-procedure developers; (2) to provide an opportunity for participants to present technical and research issues concerning Department of Energy (DOE) test procedures that need to be addressed; and (3) to assist DOE and NBS in establishing a future agenda for the development and/or revision of testing and rating procedures. The report summarizes discussions, conclusions and recommendations developed by the forum participants for the following consumer products: heat pumps and air conditioners; furnaces, boilers, and household heaters; water heaters; refrigerators, refrigerator-freezers and freezers.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 13091, 13092, 13093, 13262, 13299, 13451, 13594, 13732, 13733, 14247, 14274, 14343, 14344, 14355, 14367, 14382, 14383, 14384, 14385, 14386

13581 **(AD-A—173884/8/XAB) Health and environmental effects data base assessment of US Army waste material. Report for 4 April 1984-30 April 1985 on Phase 1.** Weber, Dennis O.; Werschulz, P.P.; Pollack. (Carltech Associates, Columbia, MD (USA)). 4 Mar 1986. 57p. (CARLTECH—8447). NTIS, PC A04/MF A01.

The U.S. Army uses a variety of substances on a regular basis in accomplishing the missions of training, defense, and weapons development. These materials include pyrotechnics, fuels, explosives, obscurants, propellants, solvents, lubricants, preservatives, and chemical intermediates. The diversity of the substances brings about a wide range of uses, storage and disposal methods. Humans and the environment are exposed to these substances in varying amounts. The U.S. Army Medical Bioengineering Research and Development Laboratory was charged with identifying hazards of materials currently being used by the Army. Proper research planning required identification of the compound and, especially, informational gaps in health and environmental data. What is required, therefore, is development of a data base on health and environmental effects of waste materials generated by the U.S. Army. This project was divided into two phases: Phase I consisted of identification of Army-unique materials for inclusion in the data base; and Phase II consisted of researching, aggregating, and reporting data on physical, chemical, health, and environmental properties of the substances identified in Phase I and identifying data gaps. This report covers Phase I efforts.

13582 **(INIS-mf—10064) Radiation security regulation. 1st revision.** (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1984. 160p. (In Spanish). NTIS (US Sales Only), PC A08/MF A01. File Number DE86780523.

Established are allowable maximum levels for personnel occupationally exposed to ionizing radiation in the ININ and for the public, in accordance with the international standards; defined are categories of radiation facilities, requirements and operating conditions that must be met. Demarcated are the kinds of placards to be posted in controlled and restricted areas and the signs, symbols and tags to be used, defined, and established is environmental dosimetric and medical radiation monitoring. Regulated are methods for handling sealed and unsealed sources of radiation, work clothes, closing of radiation installations, storage, transfer, and transport of radioactive material; classified are types of possible radiation accidents, action to be taken upon the occurrence and subsequent cleanup.

13583 **(INIS-mf—10113) Regulations under the Radiation Protection and Control Act, 1982, No. 27 of 1984.** (International Atomic Energy Agency, Vienna (Austria)). 8 Mar 1984. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780535.

These regulations provide for the control and administration of transporting, packaging and storing radioactive materials in South Australia. Such operations must be carried out in accordance with the Code of Practice for the Safe Transport of Radioactive Substances, the present Regulations and the IAEA Regulations for the Safe Transport of Radioactive Materials (1973 Edition), slightly amended for purposes of national application.

13584 **(INIS-mf—10114) Regulations under the Radiation Protection and Control Act, 1982, No. 221 of 1984.** (International Atomic Energy Agency, Vienna (Austria)). 8 Nov 1984. 1p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780536.

These Regulations made under the Radiation Protection and Control Act of 1982, amend several numerical quotations contained in the Radiation Safety (Transport) Regulations, No. 27, 1984, also made under the above-mentioned Act.

13585 **(INIS-mf—10115) Radiation Protection and Control Act, 1982, No. 47 of 1985. Ionizing radiation regulations, 1985.** (International Atomic Energy Agency, Vienna (Austria)). 4 Apr 1985. 115p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780537.

These regulations provide for the control, administration, possession and use of radiating substances and irradiating apparatus. They contain detailed provisions concerning the licensing, sale, registration and maintenance of irradiating apparatus and radioactive substances. Provisions address the therapeutic and research purposes of radioactive substances and irradiating apparatus, as well as requirements for monitoring, record-keeping and medical examinations. Also included are detailed procedures for radiation accidents and emergencies. These Regulations revoke the Radioactive Substances and Irradiating Apparatus Regulations, 1962, and the Ionizing Radiation (radioactive ores) Regulations, 1982.

13586 **(INIS-mf—10116) Regulations under the Radiation Protection and Control Act, 1982, No. 165 of 1985.** (International Atomic Energy Agency, Vienna (Austria)). 29 Aug 1985. 2p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780538.

These Regulations amend the Ionizing Radiation Regulations No. 47 of 1985. These minor amendments concern further clarifications of certain parts of the text.

13587 **(INIS-mf—10118) Decree No. 84-986 of 6 November 1984 publishing the Agreement between the Government of the French Republic and the Government of the Federal Republic of Germany on exchange of information in case of an incident or accident which could have radiological consequences, signed in Bonn on 28 January 1981.** (International Atomic Energy Agency, Vienna (Austria)). 8 Nov 1984. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780059.

This Agreement between France and the Federal Republic of Germany provides for the setting up of an appropriate system for the Parties to be mutually informed without delay of any incident or accident occurring in either of their territories, likely to affect the territory of the other State, in particular, those which may occur in a nuclear power plant and which might have radiological consequences. The Agreement entered into force on 6 August 1981. (NEA)

13588 **(PB—87-101242/XAB) Human variability in susceptibility to toxic chemicals. I. Noncarcinogens.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Feb 1986. 80p. (EPA—600/8-86-033). NTIS, PC A05/MF A01.

The tenfold safety factor traditionally used to guard against human interindividual differences in susceptibility to toxicity is not based on human observations. Some support for a tenfold dose reduction is based upon the distribution of profit slopes from acute toxicity in animals. Although human data are preferable, epidemiologic data are unlikely to have precise exposure measurements. To study human interindividual variability, the authors used papers from the recent pharmacological literature to construct a data base of individual measurements of key pharmacokinetic parameters for specific substances (mostly drugs). The parameters studied, elimination halflives, maximal blood concentrations and area under the

curve (AUC) of blood concentrations are only components of overall susceptibility to toxic agents, and do not include variability parameters that would affect exposure and response, nor from age or illness. 72 of the 101 data sets studied were positively skewed, indicating that the distributions are generally closer to log-normal distribution than a normal distribution.

13589 **(PB—87-108387/XAB) School science laboratories: a guide to some hazardous substances.** (Council of State Science Supervisors, Lancaster, VA (USA)). 1984. 52p. NTIS, PC A04/MF A01.

The guide to hazardous substances is a supplement to the NIOSH Manual of Safety and Health Hazards in the School Science Laboratory. Chemicals listed in the publication include explosives, carcinogens, mutagens, and highly toxic or corrosive or irritant chemicals. The listing is intended to identify certain potentially hazardous substances that may exist in school laboratories and encourage proper storage, handling or removal of the material from the students environment. Safety recommendations are offered including proper work habits, safety equipment to wear, safety equipment to have on hand, purchasing of various substances, disposal of hazardous wastes, various less hazardous chemicals which can be substituted for the more hazardous ones, provisions for emergency phone numbers, recommendations for inspections of stored chemicals, specific storage requirements, and hazards which may be present during storage of various materials. According to the guide, the decision to use certain substances in the school laboratory should be based on the best available knowledge of the hazards of each chemical and the availability of proper handling facilities.

13590 **(PB—87-113809/XAB) Cleaning Illinois: status of the state's hazardous-waste cleanup programs, Spring 1986.** Luly, K. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Land Pollution Control). 1986. 44p. (IEPA/GCA—86/016). NTIS, PC A03/MF A01.

Since shortly after World War II, man-made chemicals have become ever-more-pervasive elements in our society. With their escalating use have come new problems and the recognition of increasing risks. One response to the challenge posed by early efforts to dispose of these substances and their byproducts was enactment at the Federal level of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), adopted in 1980, and its attendant $1.6 billion hazardous-substance to clean up abandoned hazardous-waste sites as they are identified, even when the responsible parties cannot be found or are unable or unwilling to undertake the clean up. Illinois, second only to New Jersey in generating hazardous wastes, has acknowledged the scope of its problem by supplementing the Superfund program with two initiatives of its own, Clean Illinois and Build Illinois, which together have earmarked $110 million over a five-year span to fund cleanups.

13591 **(PB—87-124046/XAB) Environmental programs in Alaska: an EPA (Environmental Protection Agency) report 1986.** (Environmental Protection Agency, Seattle, WA (USA)). 1986. 14p. (EPA—910/9-86/152). NTIS, PC A02/MF A01.

The report discusses from an EPA perspective the major environmental issues in Alaska today. The status of the federal-state partnership is emphasized. Following the description of important issues, EPA's grants to the state are listed.

2904 Natural Resources

REFER ALSO TO CITATION(S) 13110, 13682, 13682, 14302, 14346

13592 **(INIS-BR—443) MME: activities report 1983.** (Ministerio das Minas e Energia, Brasilia (Brazil)). 1984. 53p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780513.

Presented, in a summary form, is the performance of MME (Brazilian Mine and Energy Ministery) in the energy and mine area, during 1983. The results of this action can be seen in the petroleum, electrical and mineral sector.

13593 **(PB—87-102125/XAB) Mineral consumption forecasting: standardizing and comparing forecasts. Information Circular.** Bennett, J.B. (Bureau of Mines, Washington, DC (USA)). 1986. 24p. (BM-IC—9082). NTIS, PC A02/MF A01.

Library of Congress catalog card no. 86-600082.

The Bureau of Mines report presents a method of standardizing forecasts of mineral consumption that attempts to resolve the problems caused by the use of different data bases, different definitions of minerals consumption, and different base years for making projections. Using this method, forecasts of U.S. and world mineral consumption, in the year 2000, for nine commodities (aluminum, chromium, cobalt, copper, manganese, nickel, tin, tungsten, and zinc) are standardized and compared.

13594 **(PB—87-116810/XAB) Subtitle D (of the Resource Conservation and Recovery Act) study Phase 1 report. Final report.** (Alliance Technologies Corp., Bedford, MA (USA)). Oct 1986. 253p. NTIS, PC A12/MF A01.

The report summarizes the data gathered in Phase 1 of EPA's Subtitle D study being completed in response to the 1984 Hazardous and Solid Waste Amendments. The study includes information on characteristics and management practices of nonhazardous (Subtitle D) wastes, characteristics of Subtitle D land-disposal facilities, and State Subtitle D regulatory programs. Recommendations for Phase 2 study efforts are also presented in the report. Phase 2 will culminate in the submission of a report to Congress by November 1987.

13595 **(PB—87-119012/XAB) Changes in worldwide demand for metals (final). Open File report.** Faucett, J.G.; Chmelynski, H.J. (Faucett (Jack) Associates, Bethesda, MD (USA)). Aug 1986. 181p. (JACKFAU—328-86). NTIS, PC A09/MF A01.

Worldwide demand for metals was analyzed to identify the important factors that explain differences in the level of demand among world countries. The per capita demand for steel, aluminum, copper, and total nonferrous metals was investigated for 40 to 50 countries over a 22-year period. These countries have been further grouped into four world regions for purposes of making generalizations about the importance of these factors for countries in different stages of development and with dissimilar levels of per capita gross domestic product (GDP). Intercountry and intertemporal differences are explained largely by differences in per capita GDP and changes over time in per capita GDP, oil real prices, and to a lesser extent, metal real prices. The trend in world consumption is dramatically different in the last decade than the previous one. In 1962-73, per capita consumption increased in all areas and consumption intensity (consumption divided by (GDP) increased in most areas). In 1973-84, per capita consumption fell in most areas and intensity fell dramatically, except in developing nations.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 13371, 13373, 13413, 13416, 13420, 13462, 13596

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 13262, 13296, 13298, 13299, 13316, 13462, 13495, 14343, 14344

13596 **(INIS-mf—10119) Order of 3 April 1984 on provisions relating to the Institute for Fundamental Research at the Atomic Energy Commission.** (International Atomic Energy Agency, Vienna (Austria)). 18 Apr 1984. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780060.

In accordance with the provisions of the 1975 Order setting up the Institute for Fundamental Research, this Order establishes a Scientific Council, chaired by the Director of the Institute. (NEA)

13597 **(LA-UR—86-4320) The limits of technology in nuclear crisis management.** White, P.C. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-861245—1). NTIS, PC A02/MF A01. File Number DE87003749.

From Workshop on directions in the study of crisis management; Washington, DC, USA (5 Dec 1986).

For some purposes, one may consider the roles of technology in nuclear crisis management to fall into four categories. Certain technologies, such as signals intelligence, may assist in monitoring for the emergence of crisis precursors. Other kinds of surveillance, such as that by certain satellites, are intended to detect phenomena, such as missile launches, which clearly signal the transition from pre-crisis to mid-crisis. During this phase, communications and surveillance technologies may be called upon to aid in managing the crisis. Finally, communications technologies will play a vital role in crisis resolution, preferably during the pre-crisis phase, but in mid-crisis if necessary. It has long been recognized that a large fraction of these technical means are vulnerable, both to selective, direct attack, and to the unintended, collateral effects of conflict itself. Systematic efforts are underway to make these systems more robust and survivable in crisis environments, but one must clearly recognize the limits of technology. In particular, one must weigh very seriously the implications and possible consequences of intentional, direct attack, including decapitation, on just those means which may permit timely crisis resolution. In the end, these technologies may prove so vulnerable, that nations may be forced to rely on pre-crisis planning, including force structuring, clearly defined options planning, and clear statements of intent, in order to permit any sort of mid-crisis resolution and conflict termination.

13598 **The nuclear power programs in the United States: Status and prospects.** Voigt, W.R. Jr. (Strategic Policy Analysis, US Dept. of Energy). pp 72-85 of Proceedings of the fourth Pacific Basin nuclear conference. Vogt, E.W.; Ludgate, G.A. Toronto, Ontario; The Canadian Nuclear Association (1983). (CONF-830934—).

From 4. Pacific Basin nuclear conference; Vancouver, Canada (11 Sep 1983).

The United States is committed to the use of nuclear power as a crucial element in the enormous task of supplying its energy needs. The government has already invested $13 billion in the development of commercial nuclear power, and the private sector investment has exceeded $150 billion. Admittedly, forecasts of the exact need for or extent of future electrical growth are risky and unreliable. It appears certain, however, that significant additional capacity will be required in the early to mid-1990's, if the country is to maintain a 20 percent reserve margin. For example, an electrical growth estimate of 2 to 3 percent per year, coupled with replacement of retired power plants after a 40-year lifetime, implies that an additional 300 to 500 GWe of capacity must be developed before the year 2005. For baseload capacity, the vast preponderance must be either coalfired or nuclear.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 13434, 13436, 13651, 13705, 13709, 13716

13599 **(CONF-8511246—) District heating '85. Presentation of BMFT-sponsored research projects, on the occasion of the AGFW discussion meeting 1985 at Hameln/FRG.** Gehrmann, J. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1985. 351p. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The results of R and D projects about district heating with the main subjects power plant technology, heat pumps, block heating stations, waste heat from industry, transport and distribution and monitoring are presented. Environmentally acceptable power plants with reduced NO/sub x/ and SO/sub 2/ emissions are furnished with fluidised-bed combustion, stepwise air feed to the firing place and exhaust gas desulfurisation with limestone. The use of heat pumps and the utilisation of waste heat from industry and sewage plants enable a better utilisation of primary energy. Different systems for district heat transport are presented. (HGOE).

13600 **(CONF-8511246—, pp 102-117) District heat in the Federal Republic of Germany.** Windorfer, E. (WIBERA Wirtschaftsberatung A.G., Duesseldorf, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The contribution comments the study "District heating in the Federal Republic of Germany", published in 1984 and explains why the "enforced extension of district heating" according to the aims set up in the "General study district heating" by the Federal Ministry of Research and Technology did not occur. The essential reasons have been the non-availability of cheap heat sources and the competition of the gas supply in gaining market shares which are suited for district heating. Finally the criterions for a financial district heating promotion are presented. (HGOE).

13601 **(CONF-8511246—, pp 150-156) District heat production plant with heat pump aggregates driven by gas engines and electric motors.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

A district heating network operated by a community enables different operation modes by the a tandem arrangement of gas and electro engines and refrigerant compressor. Besides of the expected saving of primary energy the economic possibilities could be best optimized according to the present need by the easily adaptable operation of the aggregates. Model calculations about the following operation modes were carried out: Cogeneration, optimal heat pump operation with boiler, and heat pump and cogeneration during the winter months. (HGOE).

13602 **(CSTB-MPE—418) Heat supply networks.** Pelletret, R.; Salagnac, J.L. (Centre Scientifique et Technique du Batiment, Etablissement Sophia-Antipolis, 6 - Valbonne (France)). Mar 1985. 48p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750975.

A code, called ASTEC, has been developed for the simulation of the steady-state, transient or periodical operation of a heat supply network. The system is broke up in isothermal elementary volumes, having their own thermal capacity. The thermal transfer between two elementary volumes (nodes) is expressed with thermal conductance. The network is thus equivalent to an electric circuit. In this article, the network and its representation through the software are described. Results of the simulation are analyzed in another statement.

2910 Conservation

REFER ALSO TO CITATION(S) 13645, 13650, 13652, 13653, 13660, 13664, 13665, 13668, 13670, 13681, 13689

13603 **(ISI-P—24-84) Summary of the first Karlsruhe talk on the subject 'Efficacy and points of attack for energy demand policy' (May 17, 1984).** (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). 17 May 1984. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751260.

On the basis of topical studies conducted at ISI (Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung) and Ifo (Institut fuer Wirtschaftsforschung, Munich) and of practical experience from the countries of the European Community, the concrete possibilities for, and obstacles to, government measures to promote efficient energy use in the Federal Republic of Germany were dis-

cussed. Lectures presented had the following headings: 1. Essential experiences with government measures to promote efficient energy use in the countries of the European Community; 2. Typical problems of an ex-post assessment of the efficacy of government measures to promote efficient energy use, 3. Points of attack for measures to exploit economic potentials of energy conservation, 4. Prospects for research and development to promote efficient use of space, cogeneration and process heat.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 13572, 13573, 13575, 13576, 13598, 14382

13604 **(BNL—38797) Representing new technologies in IFFS [Intermediate Future Forecasting System]: Extensions to the year 2010: Final report.** Kydes, A.S.; Meyer, M. (Brookhaven National Lab., Upton, NY (USA)). Aug 1986. Contract AC02-76CH00016. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004173.

The Intermediate Future Forecasting System (IFFS) does not explicitly represent technologies, except in the Electric Market Module. Therefore, this paper includes a review of the potential for direct or indirect inclusion of new technologies in IFFS which may penetrate the energy market in the 1986 to 2010 time frame. The econometric representation of technologies in IFFS requires an adjustment to the time trend parameter and prices demanded of the conventional fuels. Since new technologies, by definition, have no history, conventional methods for inclusion of new technologies into an econometric framework are difficult at best. Highlights are given for some of the new technologies.

13605 **(NP—7751159) Angola - energy situation 1985.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Sep 1986. 12p. (In German). NTIS (US Sales Only), PC A02. File Number DE87751159.

The energy situation of Angola is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on the country's trade and balance of payments.

13606 **(NP—7751160) Cameroon - energy situation 1984/1985.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Sep 1986. 19p. (In German). NTIS (US Sales Only), PC A02. File Number DE87751160.

The energy situation of Cameroon is reviewed on the basis of relevant data. Data on the country's national energy policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on the country's external trade and balance of payments.

13607 **(NP—7751164) Papers on energy economy. Lectures presented to the Forum on Economics at Bochum University.** Lassmann, G.; Liesen, K.; Niederleithinger, E.; Ziemann, W. . (Bochum Univ. (Germany, F.R.). Inst. fuer Unternehmungsfuehrung und Unternehmensforschung). Jun 1985. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87751164.

On the occasion of the Forum on Economics the Institute for Industrial Management and Research of the Bochum Ruhr University arranged for the papers contained in the publication abstracted. They were held during the 1984/1985 winter term and during the summer term 1985 and were dealing with economic and legal aspects of energy economy with particular emphasize on the following subjects: 1) The flexibility of energy economy in times of economy undergoing structural changes. 2) The diversification in energy economy - chances and limits with respect to the cartel aspect and 3) economy and industrial management of electric power supply challenged by today's requirements.

13608 **(NP—7751167) Kenya - energy situation 1985.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1986. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751167.

The energy situation of Kenya is reviewed on the basis of relevant data. Data on the country's general development are followed by an outline of trends in energy sources and electric power generation. Cooperation with West Germany on the energy sector is mentioned.

13609 **(NP—7751168) Zambia - energy situation 1985.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1986. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751168.

The energy situation of Zambia is reviewed on the basis of relevant data. Data on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Key figures are presented on the country's external trade and balance of payments.

13610 **(NP—7751257) Energy and environment. Basic conditions for the development of local and regional energy supply concepts. An analysis of the Franken, Bodensee-Oberschwaben and Schwarzwald-Baar-Heuberg regions.** Friedrich, R.; Mueller, T.; Wartmann, R. (Forschungsgemeinschaft Bauen und Wohnen, Stuttgart (Germany, F.R.)). May 1985. 432p. (In German). NTIS (US Sales Only), PC A19/MF A01. File Number DE87751257.

The report abstracted points out possible ways of developing energy supplies in the Franken, Schwarzwald-Baar-Heuberg and Bodensee-Oberschwaben regions. Each region, that is its decision making organs and consumers may refer to the report for concrete specific aids in decision making recommending supply options and pointing out their advantages and disadvantages. The regions concerned are specifically rural. As rural areas are not as flexible as industrial regions, energy analysis is a particularly important vehicle of coping with supply problems. In view of the limited scope of feasible alternatives in rural areas it is all the more important to consider them and carefully examine their possible application. Apart from discussing energy supplies the report researches into energy conservation. Another aspect referred to is the calculation of the different options' environmental impacts. Moreover, the report gives a detailed description of the characteristics and applications of systems which are not provided for by the utilities (e.g. biogas, wood, straw) and are often ignored for lack of information.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 13298, 13462, 13598, 13603, 13605, 13606, 13607, 13608, 13609, 13733

13611 **(CONF-8510391—1) Situation and perspectives of international energy policy.** Steeg, H. (Energieforum Schweiz, Bern (Switzerland)). 1985. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751157.

From Session of Energieforum Schweiz; Bern, Switzerland (3 Oct 1985).

The paper briefly describes the current energy situation and some trends and goes on to discuss the tasks of the International Energy Agency in energy policy. Those tasks include the crisis scheme of the IEA, continuation of the promotion of a long-term structural shift and world energy trade, as well as if environmental protection policy. Finally, the relations of Switzerland with the IEA are dealt with.

13612 **(PNL—6082) Cross-impacts analysis development and energy policy analysis applications.** Roop, J.M.; Scheer, R.M.; Stacey, G.S. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004203.

Purpose of this report is to describe the cross-impact analysis process and microcomputer software developed for the Office of Policy, Planning, and Analysis (PPA) of DOE. First introduced in 1968, cross-impact analysis is a technique that produces scenarios of future conditions and possibilities. Cross-impact analysis has several unique attributes that make it a tool worth examining, especially in the current climate when the outlook for the economy and several of the key energy markets is uncertain. Cross-impact analysis complements the econometric, engineering, systems dynamics, or trend approaches already in use at DOE. Cross-impact analysis produces

self-consistent scenarios in the broadest sense and can include interaction between the economy, technology, society and the environment. Energy policy analyses that couple broad scenarios of the future with detailed forecasting can produce more powerful results than scenario analysis or forecasts can produce alone.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 13110, 13138, 13139, 13143, 13143, 13176, 13179, 13179, 13194, 13200, 13203, 13214

13613 **(NP—7751169) Vertical integration of the oil-exporting countries.** Siebert, H.; Rauscher, M. (Konstanz Univ. (Germany, F.R.). Fakultaet fuer Wirtschaftswissenschaften und Statistik). May 1985. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE87751169.

In recent years a number of oil-exporting countries have been trying to extend their vertical integration on the petroleum market by seizing on production processes to be following simple oil drilling. Production comprises the installation of petroleum refineries and the establishment of a chemical feedstock industry. Besides, the respective countries are attempting to extend and intensify their influence on the distribution system. Among others, endeavours such as these are manifest in the establishment of oil tanker bases and in the countries participation in foreign distribution systems. The publication abstracted investigates into the motives of vertical integration strategies and tries to assess the economic causes of the aspirations of the oil-exporting countries in connection with the downstream sector. The publication also points out the effects of above developments and trends on the oil-importing countries.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 13326

2960 Electric Power

REFER ALSO TO CITATION(S) 13442, 13451, 13629, 13677, 13717

13614 **(DOE/IE—0007) Power system emergency reporting procedures.** (USDOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC. Office of Energy Emergency Operations). Dec 1986. 12p. NTIS, PC A02/MF A01. File Number DE87004227.

This pamphlet updates the Department of Energy's (DOE) "Power System Emergency Reporting Procedures" dated September 1983. It reflects changes to the regulations set forth in Title 10 Part 205 Subpart W of the Code of Federal Regulations, Sections 205.350-205.354, published on October 31, 1986, and recognizes current DOE organizational alignments.

13615 **(EPRI-EL—4927-Vol.1) Practical methods to integrate load management into normal operations of power system control centers: Volume 1, Final report.** Chan, M.L.; Albuyeh, F.; Imamura, D.; Mesbah, G. (ECC, Inc., San Jose, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 141p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920161.

The number of utility load management installations has increased markedly in recent years - from less than 50 in 1979 to 259 in 1985. Case studies using Florida Power and Light data show that the decision-support software developed in this study can save time and effort in integrating load management into power system operations. This volume contains the main body of the report for this project, including the survey results, the primary factors for the formulations of the decision-support subsystems, essence of the formulations, solution techniques and mode of using them, and the case studies.

13616 **(EPRI-EL—4927-Vol.2) Practical methods to integrate load management into normal operations of power system control centers: Volume 2, Appendixes: Final report.** Chan, M.L.; Albuyeh, F.; Imamura, D.; Mesbah, G. (ECC, Inc., San Jose, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 212p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920162.

The number of utility load management installations has increased markedly in recent years - from less than 50 in 1979 to 259 in 1985. Case studies using Florida Power and Light data show that the decision-support software developed in this study can save time and effort in integrating load management into power system operations. This volume contains all the backup data and information, including detailed description of the decision-support subsystems and case studies.

13617 **(EPRI-EL—5003-CCM-Vol.3) Load modeling for power flow and transient stability computer studies: Volume 3, LOADSYN [Load Model Synthesis] code user's manual.** Price, W.W.; Wirgau, K.A.; Murdoch, A.; Nozari, F. (General Electric Co., Schenectady, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 151p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920202.

By transforming utility load-mix data for use in standard load flow and transient stability programs, the LOADSYN software makes it easy for power system analysts to produce new, more accurate load models for system simulations. Better models can better predict power system behavior and thus bring improvements in transmission system utilization and planning.

13618 **(EPRI-EL—5003-CCM-Vol.4) Load modeling for power flow and transient stability computer studies: Volume 4, LOADSYN code program reference manual.** Price, W.W.; Wirgau, K.A.; Murdoch, A.; Nozari, F. (General Electric Co., Schenectady, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 339p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920239.

This report presents a summary of the development of the Load Model Synthesis (LOADSYN) computer software, which transforms data on load class mix, composition, and characteristics into the form required for commonly-used power flow and transient stability simulation programs, including the EPRI (RP1208), Philadelphia Electric, and Power Technologies, Inc. (PSS/E) programs. The load modeling software is designed for ease of use by electric utility engineers, with default data provided for load composition and characteristics. This volume describes the internal structure and variables of the Load Model Synthesis programs, including the detailed requirements specification and instructions for interfacing with additional power flow and stability programs.

13619 **(EPRI-EL—5003-Vol.2) Load modeling for power flow and transient stability computer studies: Volume 2, Load-modeling reference manual: Final report.** Price, W.W.; Wirgau, K.A.; Murdoch, A.; Nozari, F. (General Electric Co., Schenectady, NY (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 225p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920238.

By transforming utility load-mix data for use in standard load flow and transient stability programs, the LOADSYN software makes it easy for power system analysts to produce new, more accurate load models for system simulations. Better models can better predict power system behavior and thus bring improvements in transmission system utilization and planning. This volume is intended to assist power system analysts in the process of developing and using load models for power flow and transient stability studies. It covers load modeling philosophy, data sources, and the models and methods developed in this project.

13620 (EPRI-P—5028) Evaluating the effects of time and risk on investment choices: A comparison of finance theory and decision analysis: Final report. Morris, P.; Kalbe, L. (Applied Decision Analysis, Inc., Menlo Park, CA (USA); Charles River Associates, Inc., Boston, MA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Jan 1987. 49p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920249.

A comparison of the two major methodologies for incorporating time and risk into investment evaluations indicated that the two are complementary rather than alternative approaches. Use of both finance theory and decision analysis will give decision makers a broader perspective of the value of potential capital investments.

13621 (NP—7751162) Part played by public-private electric utilities in the restriction of communal self-supply. A case study, example: RWE. Ahlbrink, H. (Institut fuer Angewandte Oekologie e.V., Freiburg im Breisgau (Germany, F.R.)). Dec 1985. 201p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE87751162.

The central statement of the work is: Owing to the profit orientation of public utilities by private capital on the one hand, and the fact that this orientation is also represented in the communities, as far as they engage themselves in the utility sector by their interests in public-private enterprises on the other hand, the rise in the sale of the commodity electricity has become the sole criterion of success. Then, because of the success of public-private enterprises on the basis of increasing power sales and in consequence of growing regional cooperation, municipal self-supply structures are bound to be suppressed and communities suffer the loss of whatever scope of action they may have had in energy policy. That situation is more and more damaging to a growing need at the consumption, i.e. the regional and local level, for energy-political action and planning. The Nordrhein-Westfaelisches Elektrizitaetswerk (RWE), Essen, is an outstanding example. That group is one of the oldest, and the biggest, public-private undertaking in the electricity sector. It affords more than one third of the total public power supply of West-Germany. The group, being the most powerful interconnected power system in West-Germany, is the embodiment of the cooperation between private capital owners and public bodies. That is why this outstanding example serves to demonstrate the importance of, and part played by, public-private utilities. The central concern of the investigation is to trace both the circumstances of the creation of the public-private utility and the consequences of the merging of the part corporations.

13622 (NP—7751165) Electric power prices: Regulations applying to the operation of sewage plants. Kunz, P. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). Jul 1985. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751165.

Different analyses of the Fraunhofer Institute for Systems Technology and Innovation on energy consumption and electric power consumption in particular (Kunz, Mueller; 1985) as well as on feasible ways of energy conservation (Kunz, Schroeder; 1985) in sewage plants turned out to be indicative of the ignorance and considerable deficiencies and misinformation with respect to the structure of electric power prices and their underlying agreements (regulations) between the public utilities and the consumer (tariff contracts or large consumers). The latter puts up with a supposed unalterableness of the terms of electric power supply contracts. The publication abstracted therefore first of all points out the different elements of power supply contracts. Apart from the special agreements which as a rule include the municipal sewage plants the publication briefly refers to the tariff contract usually including external pumping stations and the like. The final chapter is dedicated to the description of a model allowing the analysis of sewage plant electric power accounts based on the result of which minimum demands may be calculated and used as a measure in arranging the most favourable and adequate conditions of contract.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 13604, 13672

13623 (EPRI-EM—4988-Vol.2) Industrial end-use planning methodology (INDEPTH): Demonstration of design: Volume 2, Process models: Interim report. (Battelle Columbus Labs., OH (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA); Sparrow (F.T.) and Associates, West Lafayette, IN (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 276p. Research Reports Center, Box 50490, Palo Alto CA 94303. File Number TI87920212.

The INDEPTH industrial planning methodology will enable utilities to forecast service area electricity demand. The system allows the user to develop energy forecasts for the whole industrial sector, to examine industries most important to the service area, and to study uses of electricity that are of interest in demand-side management programs. The process models forecast the future electricity consumption of a given industry by simulating the electricity-consuming technologies and production processes in that industry. The industry processes modeled were textiles, pulp and paper, chloralkali, petroleum, glass, foundry, metals fabrication, and automotive stamping.

13624 (EPRI-EM—4988-Vol.3) Industrial end-use planning methodology (INDEPTH): Demonstration of design: Volume 3, Equipment models: Interim report. (Battelle Columbus Labs., OH (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA); Sparrow (F.T.) and Associates, West Lafayette, IN (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 107p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920213.

The INDEPTH industrial planning methodology will enable utilities to forecast service area electricity demand. The system allows the user to develop energy forecasts for the whole industrial sector, to examine industries most important to the service area, and to study uses of electricity that are of interest in demand-side management programs. The equipment models in this volume simulate the purchase, use, and retirement of various types of energy-consuming equipment throughout the industrial sector. They assess the effects of utility incentives on the market penetration of specific electrotechnologies and thus on electricity use. The equipment modeled included motors, lighting, chillers, dryers, space conditioning, and furnaces for all two-digit manufacturing industries.

13625 (NP—7751158) Model for the electricity demand of private households with indirectly observed variables. Flaig, G. (Augsburg Univ. (Germany, F.R.). Inst. fuer Volkswirtschaftslehre). May 1985. 30p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751158.

A first approach in the existing studies considers electricity practically as an ordinary, consumer good. Those studies overlook that hardly any consumer wants energy for its own sake, but because it provides him - together with household applicances and housework - with the goods and services he can profit by. The second approach, so far predominantly represented in the investigations by institutions concerned with economic science, holds that the consumption of electric power is determined by the development of the stock of household appliances. The specific consumption coefficients are mostly assumed either to correspond to certain values or to depend mainly on technical developments. This work takes a closer look at some of the problems mentioned and suggests solutions. First of all a simple micro-economic model is developed which provides a theoretical framework for the specification of the electricity demand function. On comparing the theoretically defined variables with the actually available data it is seen that these are, at best, indicators fraught with measuring errors. Therefore an appropriate estimation method is made use of. In the last section the estimation results for three variants of the electricity-demand model are presented and the implications for power consumption forecasting discussed.

13626 **Recent changes in US energy consumption: What happened and why.** Hirst, E.; Barnes, R.; Greene, D.; Marlay, R. (Energy Division, Oak Ridge National Lab, Oak Ridge, TN). pp 153-202 of Learning about energy. New York, NY; Plenum Press (1986).

Tables show that energy use trends during the past few years have been dramatically different from those of the 1950's and 60's. Energy use in 1981 was shown to be slightly lower than in 1973. Statistics show that energy intensiveness of the U.S. economy declined sharply in the past few years, and is likely due to rapid increases in real energy prices in the 1970's. Regression models of U.S. energy use as a function of GNP, average energy price, federal expenditures on energy conservation programs, and last year's energy use were developed and analyzed. Types of energy used in the residential/commercial buildings sector are compared in terms of costs, area space, and energy intensity. An analysis of the industrial sector is given, and the kinds of activity that can produce changes in the level and intensity of industrial energy consumption are explored. Trends in individual fuel use reveal a decline in the industrial use of solid fuels between 1947 and 1980, and the effects of conservation and other factors are discussed. Total energy use, from 1950-1970, for transportation increased at an annual rate of 2.9% from 8.6 to 15.3 quads, and has been increasing steadily since.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 13343, 13371, 13373, 13413, 13416, 13420

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

13627 **(N—87-10764) Laser-powered MHD generators for space application.** Jalufka, N.W. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1986. 15p. (NASA-TP—2621; NAS—1.60:2621). NTIS, PC A02/MF A01.

Magnetohydrodynamic (MHD) energy conversion systems of the pulsed laser-supported detonation (LSD) wave, plasma MHD, and liquid-metal MHD (LMMHD) types are assessed for their potential as space-based laser-to-electrical power converters. These systems offer several advantages as energy converters relative to the present chemical, nuclear, and solar devices, including high conversion efficiency, simple design, high-temperature operation, high power density, and high reliability. Of these systems, the Brayton cycle liquid-metal MHD system appears to be the most attractive. The LMMHD technology base is well established for terrestrial applications, particularly with regard to the generator, mixer, and other system components. However, further research is required to extend this technology base to space applications and to establish the technology required to couple the laser energy into the system most efficiently. Continued research on each of the three system types is recommended.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 13560, 13690, 13691, 13692, 13693, 13694, 13695, 13696, 13697, 13760

13628 **(CONF-860304—11) Material critical issues for phosphoric acid and carbonate fuel cells, 1986.** Hooie, D.T.; Camara, E.H. (Engelhard Corp., Edison, NJ (USA); Institute of Gas Technology, Chicago, IL (USA)). 1986. 8p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900446.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

The current primary life-limiting factor for fuel cells is material stability. Fuel cells operate at moderate (475K) to high (925 to 1275K) temperatures in a variety of mediums and as a result, each has its own unique set of material stability concerns. The material critical issues for phosphoric acid and carbonate fuel cells are discussed.

13629 **(EUR—10729-EN) Phosphoric acid fuel cell for electrical power generation: Development and penetration in the EEC countries. Final report.** Sabbioni, F.; Imbimbo, E.; D'Ignazio, P.D.; Steel, M.C.F.; Ryan, F.J.; Pilkington, C.E. (Commission of the European Communities, Luxembourg. Directorate General Information Market and Innovation). 1986. 236p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Energy.

The objective of this study is to assess the potential market for PAFC for electrical power generation in EEC countries and to analyze the factors influencing future market penetration. The countries of the European Community in contrast with their geographic and economic unity are very diversified internally. The study analyzes, for each country, the structure of the electrical system, the projections of the electrical demand up to the year 2010, and the national policies on primary energy utilization. The fuel cell accessible market has been estimated on the basis of technical and economic evaluations and of the positive and negative factors that can influence penetration in each EEC country. One of the principal purposes of this study is to provide a basis for an European development programme on fuel cells for power stations.

13630 **(PB—87-115283/XAB) Electrochemical characteristics of acid electrolytes for fuel cells. Annual report, August 1985-June 1986.** Razaq, M.; Yeager, E. (Case Western Reserve Univ., Cleveland, OH (USA)). Jul 1986. 60p. NTIS, PC A04/MF A01.

Electrochemical characterization of a number of perfluorinated phosphinic and phosphinic acids and sulfonyl imides was carried out with the emphasis on the identification of alternate acid electrolytes that could replace the presently used phosphoric acid as an electrolyte in O_2-H_2 fuel cell. Oxygen reduction activity on smooth platinum and on gas fed high-surface-area platinum-catalyzed electrodes (Pt on XC-72 carbon support, Pt loading 10%) was examined. The polarization for oxygen reduction in bis(trifluoromethane sulfonyl) imide has been found to be less cathodic compared to that observed in phosphoric acid. The conductivities of both dilute and concentrated acids as a function of temperature were measured. The contact angle of concentrated acids with Teflon at 20°C were also measured, and for the bis(trifluoromethane sulfonyl) imide it is greater than 90°C.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 13404, 13406, 13625, 13716, 13840, 14295

13631 **(AD-A—173266/8/XAB) Measured performance of variable-air-volume boxes. Interim report.** Krajnovich; Hittle, D.C. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1986. 27p. (CERL-E—86/07). NTIS, PC A03/MF A01.

This report documents the results of work conducted to measure the performance of currently available variable-air-volume (VAV) boxes in terms of pressure independence, linearity, and hysteresis. This work was part of research being conducted to develop control systems for simple and reliable retrofit applications to heating, ventilating, and air-conditioning systems. General conclusions of the study indicated that the performance characteristics of VAV boxes vary widely and that this variation is likely to continue until consistently applied manufacturing standards are implemented. The tests also showed that most VAV boxes do not quite meet the manufacturers performance claims. A general problem is the boxes' inability to conform to specified minimum and maximum flow rates; although recalibration to give the desired flow rates is possible, it would be a difficult, time-consuming procedure in the field.

13632 **(CONF-870101—4) Laboratory examination and seasonal analysis of frosting and defrosting losses for an air-to-air heat pump.** Miller, W.A. (Oak Ridge National Lab., TN (USA)). [1986]. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004274.

From American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting; New York, NY, USA (18 Jan 1987).

An air-to-air split-system residential heat pump of nominal 2 3/4-ton (9.7-kW) capacity was instrumented and tested in the laboratory. The coefficient of performance, system capacity, and component efficiencies were measured during steady-state and frosting-defrosting conditions in the heating mode (1) to gain better understanding of the physical processes that affect the performance of the test heat pump and (2) to quantify the frosting and defrosting losses. Cumulative frosting and defrosting loss coefficients were calculated from which empirical frosting and defrosting algorithms were developed for modeling of frosting and defrosting losses. Seasonal analyses indicate that the test heat pump with tube-and-wavy-fin outdoor coil had 1% to 5% energy loss due to frosting and demand defrosting accounted for only an additional 1% to 3% yearly energy loss. Demand defrost control can reduce yearly frosting-defrosting losses by 5% to 10% over 90- and 45-minute time-temperature controls.

13633 **(CONF-870101—5) Research requirements in the evaporative cooling field.** Turner, R.H.; Chen, F.C. (Oak Ridge National Lab., TN (USA); Nevada Univ., Reno (USA). Dept. of Mechanical Engineering). Jan 1987. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004280.

From American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting; New York, NY, USA (18 Jan 1987).

This paper focuses on potential applications of evaporative cooling (EC) and an associated survey of research requirements of EC as supplied in residential and small commercial buildings. To prepare this work, the literature in the field was reviewed and people active in the field were contacted. Sixteen recommendations are presented and described in the paper including institutional issues, appropriate roles for EC systems, necessary analysis and testing, proper applications, and hardware development needs. These recommendations represent composite opinions from the literature review and phone conversations as analyzed by the authors.

13634 **(CSTB-MPE—419) Modelling and simulation of building thermics and associated energy systems.** Sornay, J. (Centre Scientifique et Technique du Batiment, Etablissement Sophia-Antipolis, 6 - Valbonne (France)). Mar 1985. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750976.

The aim of this study was to expose the various thermal energetic building simulation codes developed for the CSTB at Sophia-Antipolis. The CSTBat code offers the possibilities of a meteorological data library, an insolation data processing (calculating irradiation fluxes on a certain plan), calculation of the shadow due to architectural structures, and calculation of the thermal behaviour of an air volume. A second code is presented, that analyzes fine heat transfers through building envelopes. The development of various precise modelling codes for the simulation of parts of systems (not global simulation) is also studied as well as the simulation of the relations between the sub-systems.

13635 **(DOE/CE/63474—T3) Redwood Community Action Agency: Technical progress report, 3rd quarter, 1986.** (Redwood Community Action Agency, Eureka, CA (USA)). 1986. Contract FG01-86CE63474. 75p. NTIS, PC A04. File Number DE87004193.

Since the second quarter, at which time venture feasibility activities were well underway by Redwood Community Action Agency (RCAA) to develop a shared-savings energy business plan, significant progress has been made. Nearly all consultant reports on the technical feasibility analysis have been completed, initial market research has begun and capitalization strategy has been investigated. Additionally, RCAA received an award of a substantial grant from the California Dept. of Economic Opportunity to develop a series of business ventures with a consortium of Northern California community providers. Fifteen thousand dollars of equity capital has been allocated for the energy-related business venture being investigated under this grant. If all plans go as anticipated, this money, combined with agency unrestricted funds, will provide the initial seed capital for the venture.

13636 **(DOE/CE/63474—T4) Redwood Community Action Agency: Technical progress report, 4th quarter, 1986.** (Redwood Community Action Agency, Eureka, CA (USA)). 1986. Contract FG01-86CE63474. 52p. NTIS, PC A04. File Number DE87004194.

Redwood Community Action Agency (RCAA) has been developing a business plan for a shared-savings energy business under this grant since January, 1986. At this time RCAA is nearing completion of the research activities, although a 90 day no-cost extension has been requested and received to complete activities on this grant. All consultant reports on the technical feasibility analysis and market research activities have been completed at this time. Fifteen thousand dollars of equity capital has been allocated for the business venture being investigated under this grant through an equity grant from the California Department of Economic Opportunity. This money, combined with agency unrestricted funds, will provide the initial seed capital for the venture.

13637 **(DOE/CE/63477—T3) MCCAA [Mercer County Community Action Agency] residential ESCO [Energy Service Company] market study: [Technical progress report for the period January 1, 1986 through December 31, 1986].** (ACTION-Housing, Inc., Pittsburgh, PA (USA)). [1986]. Contract FG01-86CE63477. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004458.

The Mercer County Community Action Agency has become interested in the possibility of expanding the scope of their energy conservation activities to the larger population, those homeowners whose income disqualifies them for publicly-funded weatherization programs, but who may be willing to purchase similar energy reduction and comfort enhancing services from a private entity. This market study attempts to describe the potential market for residential energy management services in Mercer County and to offer relevant strategies for developing a for-profit, residential energy service company capable of responding to the specific market conditions uncovered.

13638 **(DOE/OR/00033—T260) The role of electricity in home heating.** Burwell, C.C.; Phung, D.L. (Oak Ridge Associated Universities, Inc., TN (USA)). Feb 1986. Contract AC05-76OR00033. 15p. NTIS, PC A02/MF A01. File Number DE87004883.

Recent changes in the electricity to natural gas price ratio suggest that the potential market for electric home heating is substantial and improving. The residential customer's choice of home heating alternatives will depend upon total system cost-effectiveness, not simply the engineering rated efficiency of the heating system. This paper presents the results of several studies as evidence of comparative levels of end-use energy consumption for home heating. These analyses of metered residential usages of electricity and gas suggest an enhanced total effectiveness of electric heating compared to fuel heating. How far into the future the advantage for electricity will persist will depend upon gains in electric heating technology as well as its cost ratio with other fuels. Historically, the trend toward electrification of home heating began with the increased availability of electrical energy and accelerated when the price of oil and natural gas began to rise in the early 1970s. Even though today's oil prices are stable and declining, they still generally remain higher than natural gas and are higher than during the mid-1970s when a strong incentive existed to use electric home heat.

13639 **(LBL—20557) Avoided gigawatts through utility capital recovery fees and marginal cost pricing of electricity.** Rosenfeld, A.H.; Verdict, M.E. (California Univ., Berkeley (USA). Dept. of Physics; Lawrence Berkeley Lab., CA (USA); Texas Public Utility Commission, Austin (USA)). Jun 1986. Contract AC03-76SF00098. 11p. (CONF-860818—16). NTIS, PC A02/MF A01. File Number DE87004478.

From American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings; Santa Cruz, CA, USA (17 Aug 1986).

Advances in building technologies and appliance efficiencies have the combined potential to save up to 50% of the electricity demand of new buildings. This paper will discuss the advantages and disadvantages of using capital recovery fees for utility hookups and marginal cost pricing of electricity to defer the construction of more than 100 GW of peak power capacity power plants over the next 20 to 40 years, saving $10 to 20 billion per year in reduced electricity bills to consumers.

13640 **(LBL—21886) Analyzing energy conservation retrofits in public housing: Savings, cost-effectiveness, and policy implications.** Greely, K.M.; Goldman, C.A.; Ritschard, R.L. (Lawrence Berkeley Lab., CA (USA)). Jul 1986. Contract AC03-76SF00098. 35p. (CONF-860818—14). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003526.

From American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings; Santa Cruz, CA, USA (17 Aug 1986).

Annual energy costs for the US's 1.2 million public housing units exceed one billion dollars. During the last decade, the US Department of Housing and Urban Development (HUD) and local public housing authorities have initiated major conservation programs. Our review of energy conservation work in public housing indicated that in spite of substantial retrofit activity, little documented information is available on energy savings from retrofits. In this paper, we calculate energy savings and economic indicators for 43 retrofits, using consumption and cost data collected from case studies, housing authorities, and utilities. These results are compared with savings from conservation measures in privately owned, multi-family housing. Heating system controls and window measures were the two most frequent retrofit strategies in the housing projects we examined. Median energy savings are 14% of pre-retrofit consumption, or 11.2 MBtu/unit-year; savings ranged from -7% to 62%. A median payback time of 12 years showed the retrofits, as a group, to be less cost-effective than a comparable sample of retrofit efforts in privately owned, multi-family buildings. We also examine the persistence of energy savings for a small sample of buildings for which we have several years of post-retrofit utility billing data; preliminary results suggest that proper maintenance is a critical factor in sustaining energy savings after temperature control retrofits in steam-heated buildings. Finally, we discuss qualitative factors that influence the acceptability of retrofits, including effects on comfort, building appearance, and security.

13641 **(LBL—21976) Keeping warm: Findings from the Kansas City warm room retrofit project.** Wagner, B.S.; Diamond, R.C. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 14p. (CONF-860818—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003522.

From American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings; Santa Cruz, CA, USA (17 Aug 1986).

The warm room retrofit is a response to a common problem: how to stay warm in a large, poorly insulated house during the coldest parts of winter. The problem is especially acute for low-income and elderly homeowners who may not have sufficient resources to improve the thermal integrity of their entire house. Although still an experimental technique, the warm room retrofit has the potential for achieving significant energy savings in houses at costs similar to those currently allocated by low-income weatherization programs. The retrofit is a combination of zoning, heating systems modification and insulation which allows the occupant to heat selected areas of her home while maintaining the unused areas at a cooler temperature. This study presents the results from a retrofit project in Kansas City, sponsored by the Urban Consortium in 1985 to 1986. Nine houses were selected for the study, four controls and five houses that received the warm room retrofit. The houses are all single-family detached structures, occupied by low-income owners (with the owners' ages between 60 and 80 years), and heated with gas-fired, forced-air or gravity-fed furnaces. The warm zone was designed to include the kitchen, bathroom, and one to two additional rooms, depending on family size. The costs of the retrofit averaged $1425 per house. Our analysis included regressions of total gas use versus outdoor temperatures to measure savings, which averaged 26%. Because of potential health and safety problems, we also measured indoor air quality before and after the retrofit, sampling levels of indoor radon, nitrogen dioxide, and formaldehyde. An important part of the study was to determine occupant response and the acceptability of the retrofit. The residents participated in the design of the retrofits, and were interviewed after the retrofits were installed to determine improvements in comfort and their satisfaction with the results.

13642 **(ORNL/Sub—84-89680/1) Inventory of energy research in schools of architecture, 1972-1985.** Prowler, D.; Mohler, E.J.; Aseltine, M. (Oak Ridge National Lab., TN (USA); Pennsylvania Univ., Philadelphia (USA)). Jan 1987. Contract AC05-84OR21400. 84p. NTIS, PC A05. File Number DE87005274.

This inventory was undertaken to summarize and analyze the funded building energy research conducted in schools of architecture during the period 1972 to 1985. Individual project information was sought from faculty in all the accredited schools of architecture in the United States and Canada through a mail inventory process. Principal investigators were asked to complete an inventory form for each of their research projects describing the nature and contract value of each project. Seventy-five percent of the architecture schools responded to the request for information. From these institutions, data were collected on almost three hundred projects. This information was compiled using "dBase III" database software to provide three project summaries organized by schools, by principal investigators, and by key words. The key words were selected by the principal investigators from a list of key words included in the original inventory form. Using a series of programs written in the dBase III programming language, the data were also analyzed to provide insights into research topics, trends in research emphasis over the thirteen year period covered by the study, the extent of research funding, the institutional sources of funding and their topics of research preference, and levels of institutional and principal investigator involvement in energy research.

13643 **(ORNL/Sub—86-22038/1) Review of chemical heat pump solid/vapor working media and modeling: Final report.** Hettiarachchi, S.; Urquidi-Macdonald, M. (SRI International, Menlo Park, CA (USA); Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87005289.

The project on "Review of Chemical Heat Pump Solid/Vapor Working Media and Modeling" was undertaken for Martin Marietta Energy Systems, Inc., to evaluate the ability of solid/vapor adsorption systems and hydrogen/metal hydriding systems to generate temperatures in the range of 350°F to 800°F. An exhaustive literature search and analysis showed that among the solid/vapor adsorption systems, $CaO/Ca(OH)_2$ and the zeolite/water system are potentially promising while among the hydrides, LaNi$_5$/ LaNi/sub 4.5/ Al/sub 0.5/ system appeared to be promising. Most of the mathematical models found in the literature and reported so far on solid/vapor heat pump systems consider only a steady state equilibrium approach to solve heat and mass transfer equations to calculate the average behavior and the efficiency of a CHP system. The TRNSYS program on the other hand adequately deals with the average behavior of systems in the transient mode. None of the models reviewed are adequate for the design of the hydride chemical heat pump. The major problem is the geometry dependence of the models reviewed.

13644 **(ORNL/TM—10166) Metal hydride temperature amplifiers for high temperature (>260°C) applications: A parametric study: Final report.** Ally, M.R. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 48p. NTIS, PC A03/MF A01. File Number DE87005297.

The viability of hydriding alloys as working media in heat pumps to achieve temperature boosts up to 260°C or better, is investigated on the basis of the mass transfer zone concept of absorption bed design and a return on capital investment of two years. The Van't Hoff curves or various metals in the temperature and pressure ranges of interest were found in the open literature. An integrated form of the Clausius-Clapeyron equation was used to describe the equilibrium hydrogen pressure-temperature relationship. Design equations pertaining to overall material and heat balances are presented. An inherent assumption in the development of these equations is that of steady state operation. Other, more stringent assumptions pertain to cycling stability, resistance to poisoning, constant absorption capacity and durability of the metal over a two year period. The design equations along with the necessary thermodynamic data are incorporated in an interactive FORTRAN computer program called HYDRIDE which determines the quantity of metal required per bed for an 8.79 x 10^6 W (30 x 10^6 Btu/h) temperature amplifier. The computer results show that even under the optimistic assumptions of the model, the estimated metal required per bed would be between 15,900 and 22,700 kg, depending on the particular metals chosen. Based on a metal cost of $33.07/kg and cost of energy at $5/$10^6$ Btu, the maximum permissible metal in each bed for a two year payback works out to be 4535 kg. It is therefore concluded that even under very optimistic conditions, hydriding alloys are economically unattractive for heat pump applications.

13645 **(PB—87-110912/XAB) Performance of domestic heating systems.** Fuller, T.; Minogue, P.; Finn, M.; Carroll, D. (Foras Forbartha Teoranta, Dublin (Ireland)). Apr 1986. 29p. NTIS, PC PC E03/MF E01.

The report describes, in condensed form, a project embarked upon by An Foras Forbartha in 1981 with a view to quantifying the performance of domestic central-heating systems. The overall objective of the project was to reduce energy consumption in the domestic sector, while maintaining or improving comfort conditions, by improving the performance of domestic heating systems in common use in Ireland. The performance of the heating systems was evaluated in relation to efficiency, rate of response to changes in demand, ability to meet peak loads, and ability to maintain the desired temperature regime. Improvements in temperature control and heat storage were introduced to meet some of the deficiencies identified in the systems studied, and an evaluation of the improved systems was then carried out.

13646 **(PB—87-114104/XAB) Phase I-B development of kinematic Stirling/Rankine commercial gas-fired heat-pump system. Final report, September 1983-December 1985.** Monahan, R.E. (Stirling Power Systems Corp., Ann Arbor, MI (USA)). Jul 1986. 192p. NTIS, PC A09/MF A01.

The Kinematic Stirling/Rankine gas heat pump concept is based on the application of a Stirling engine that has been under development for over a decade. The engine has been converted to natural gas and is characterized with many thousand hours of operating experience. The goal of the project is to develop a commercial-size Stirling engine-driven gas heat pump with a cooling capacity of 10-ton, and a COP (heating) of 1.8 and COP (cooling) of 1.1. The project is a multi-phase development with commercialization planned for 1989. In this phase, an HVAC systems manufacturer (Borg-Warner) is working with SPS to develop a prototype gas-heat-pump system. To date, a piston-type open-shaft refrigeration compressor was selected as the best match for the engine. Both the engine and compressor have been tested and characterized by performance maps, and the experimental heat-pump systems designed, built, and preliminary testing performed. Close agreement with computer model output has been achieved. SPS has continued to focus on improving the Stirling-engine performance and reliability for the gas-heat-pump application.

13647 **(PB—87-119897/XAB) Test-method evaluations and emissions testing for rating wood stoves. Final report, June 1985-April 1986.** Cottone, L.E.; Messer, E. (Engineering-Science, Inc., Fairfax, VA (USA)). Oct 1986. 147p. NTIS, PC A07/MF A01.

The report gives results of a comparison of three sampling methods for wood-burning stoves: the EPA Modified Method 5 (MM5), the Oregon Method 7 (OM7), and the ASTM proposed Method P180. It also addresses the effect that emission format (grams per hour, grams per kilogram wood burned, micrograms per joule heat output) has on the intermethod correlations. Five stoves (two catalytic, one noncatalytic generic, one noncatalytic high efficiency, and one catalytic fireplace insert) were tested. Test results showed good correlations between the total train emissions obtained with each method. The strength of the correlations varied with the emission format: the grams per hour format showed the strongest correlation. POM emissions showed a general (but weak) correlation with total emissions when the grams per hour format was used; there were no correlations when the emissions were expressed in either of the other two formats.

13648 **(PB—87-120044/XAB) Desiccant dehumidifier/cooling system development. Final report, December 1982-May 1985.** Rublee, P.D.; Yen, H.H. (Dunham-Bush, Inc., Harrisonburg, VA (USA)). Apr 1986. 111p. NTIS, PC A06/MF A01.

Under Gas Research Institute (GRI) sponsorship, Exxon Enterprises, Inc. developed and breadboard unit tested a patented desiccant-cooling-system concept that produced significantly higher thermal efficiencies than had previously been achieved. Based on this concept, Dunham-Bush analytically projected ARI thermal coefficients of performance (COPs) of over 1.0 to be achieveable in the breadboard desiccant cooling system. Furthermore, the first cost estimates made by Dunham-Bush for a commercial product projected an approximate 45% premium over the first-cost of a state-of-the-art electric vapor-compression air conditioner in the 5 to 7-1/2 ton size range. The estimated operating costs associated with the desiccant system, although very low, could not offset the large first-cost premium in a reasonable payback period.

13649 **(PB—87-121026/XAB) Gas-engine heat-pump cycle analysis. Volume 1. Model description and generic analysis. Technical report, June 1985-July 1986.** Fischer, R.D. (Battelle Columbus Div., OH (USA)). 24 Oct 1986. 92p. (N—4577-0200). NTIS, PC A05/MF A01.

Performance and cost information were prepared to assist GRI and the five GRI engine contractors in evaluating the selection of HVAC components, values for component design variables, and system configurations and operating strategy. A steady-state computer model for performance simulation of engine-driven and electrically driven heat pumps was prepared and effectively used for parametric and seasonal performance analyses. Parametric analysis showed the effect of variables associated with design of recuperators, brine coils, domestic hot water heat exchanger, compressor size, engine efficiency, insulation of exhaust; and brine piping. Seasonal performance data were prepared for residential and commercial units in six cities with system configurations closely related to existing or contemplated hardware of the five GRI engine contractors. Similar data were prepared for an advanced variable-speed electric unit for comparison purposes. The effect of domestic hot-water production on operating costs was determined. Four fan-operating strategies and two brine-loop configurations were explored.

13650 **(PB—87-131314/XAB) Measurements of the efficiency and refrigeration power of pulse-tube refrigerators.** Herrmann, S.; Radebaugh, R. (National Bureau of Standards, Boulder, CO (USA). Chemical Engineering Science Div.). Sep 1986. 54p. (NBS/TN—1301). NTIS, PC A04/MF A01.

Also available from Supt. of Docs as SN003-003-02771-5.

Pulse-tube or thermoacoustic refrigerators have the potential for high reliability since they require only one moving part - an oscillating piston or diaphragm at room temperature. If a tube is closed at one end and connected to a pressure-wave generator at the open end, and if the phase angle between mass flow and pres-

sure is shifted from 90°, then refrigeration occurs at the open end. The shift in phase angle can be realized by thermal relaxation between the gas and the tube walls or by an orifice at the closed end. A low temperature of 60 K using helium gas in a one-stage orifice pulse tube has been achieved at NBS. The report describes the first measurements of the efficiency, refrigeration power, and refrigeration power per unit mass flow, for three pulse-tube refrigerators. Three tube sizes, differing in length and diameter, were studied over a frequency range of 3 to 11.5 Hz. Cooling efficiencies as high as 90% of the Carnot efficiency were obtained when compressor and regenerator losses are neglected.

13651 **(PB—87-134052/XAB) System and technology concept evaluation for small commercial/residential cogeneration applications. Final report, November 1984-September 1986.** Teagan, W.P.; Wilson, R.P.; Mathias, S.; Frantzis, L. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Sep 1986. 188p. NTIS, PC A09/MF A01.

There is a growing interest in the use of small-scale, modular cogeneration (sub-30kW) systems to serve the potentially large market associated with residential and commercial buildings. However, such small systems have not yet experienced a high level of commercial success. Reasons for this include the highly variable loads often associated with these applications, economies of scale in engines and other subsystems, and the high cost of maintenance using currently available technology. This program attempted to analyze the technical, economic, and market issues associated with small scale cogeneration and thereby (1) establish target-system specifications (cost, efficiency, size) that would be sufficient to make cogeneration attractive in selected applications, and (2) identify R&D activities aimed at achieving these target specifications. Particular emphasis was given to determining how highly modular, standardized, designs might overcome some of the inherent difficulties associated with economies of scale and thereby achieve significant levels of market acceptance.

13652 **(PB—87-134326/XAB) Specifications for thermal and environmental evaluations of advanced-technology office buildings.** Persily, A.K. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Nov 1986. 96p. (NBSIR—86/3462). NTIS, PC A05/MF A01.

Specifications for conducting a thermal and environmental evaluation program for advanced technology office buildings are presented. The program is to be used by the General Services Administration (GSA) in designing and assessing the performance of these new federal office buildings. The document consists of three basic sections: (1) programing directives - a description of requirements regarding the diagnostic center and associated items, and quantitative architectural performance standards, to be used in the building design process; (2) construction specifications - detailed specifications regarding the procurement and installation of sensors and equipment for use in the evaluations, written in the Masterspec format developed by the Construction Specifications Institute; (3) work statements - detailed descriptions of each of the thermal and environmental evaluations for use in procuring the services of individuals or organizations to perform the tests. The three sections are intended for use by GSA in the design and procurement processes, and are therefore presented in formats appropriate to GSA's needs.

13653 **(PB—87-140216/XAB) Building technology project summaries, 1986.** Wright, R.N. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Dec 1986. 68p. (NBSIR—86/3490). NTIS, PC A04/MF A01.

The Center for Building Technology (CBT) of the National Bureau of Standards (NBS) is the national building research laboratory. It works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research. It develops technologies to predict, measure, and test the performance of building materials, components, systems, and practices. This knowledge is required for responsible and cost-effective decisions in the building process and cannot be obtained through proprietary research and development. CBT provides technologies needed by the building community to achieve the benefits of advanced computation and automation. CBT does not promulgate building standards or regulations, but its technologies are widely used in the building industry and adopted by governmental and private organizations that have standards and codes responsibilities. The report summarizes the projects underway in the Center during 1986.

13654 **(PNL-SA—13866) Development and implications of a software-based residential energy conservation standard.** Lee, A.D.; Pratt, R.G. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1986. Contract AC06-76RL01830. 15p. (CONF-8604290—2). NTIS, PC A02/MF A01. File Number DE87004466.

From Joint national meeting of ORSA/TIMS; Philadelphia, PA, USA (4 Apr 1986).

Development and implications of the recently completed Federal Residential Conservation Standards, uniquely software-based, are described and discussed. By law, the Department of Energy is required to develop and issue energy conservation performance standards for residential buildings. Federal agencies that procure housing will implement the standard. The objectives for the standard were to: (1) provide performance-based requirements; (2) use cost-effectiveness criteria; (3) accommodate local and changing conditions; and (4) maximize ease of use. A software-based format seemed singularly able to achieve these objectives. The program is described and samples of its output are illustrated. Next, issues related to the acceptability of a software-based standard are discussed. Public review and comment should help reveal and evaluate advantages, disadvantages, and potential problems of using a software format for standards, and should help assess the potential for software-based standards in the private sector.

13655 **Solid state radiative heat pump.** Berdhal, P.H. (to Dept. of Energy, Washington, DC). US Patent 4,628,695. 16 Dec 1986. Filed date 28 Sep 1984. v.p.

This patent describes a solid state radiative heat pump comprising: a thin film semiconductor having an active surface and a back surface and being capable of emitting an infrared radiation deficit from the active surface when a charge carrier deficit is present in the semiconductor, enhancing means for enhancing transmission of infrared radiation through the active surface from inside the semiconductor to outside thereof and vice versa, inhibiting means for inhibiting transmission of infrared radiation through the back surface of the semiconductor, means for producing a deficit of charge carriers in the semiconductor.

13656 **(BG-Trans—15027) Study and development of high-performance absorption chiller-heater (2) static computer simulation model.** Nagaoka, Y.; Nishiyama, N. (British Gas Corp., London; Tokyo Gas Research and Development Inst. (Japan)). 8 Dec 1986. Translated from 30th annual report of Tokyo Gas Research and Development Institute, pp 97-119. 32p. NTIS (US Sales Only), MF A01. File Number DE87900420.

This report discusses the results of an analysis of the characteristics of the double effect absorption chiller-heater, from the point of view of heat transfer. The results of the analysis indicate that the elements exerting the biggest influence on the efficiency of this installation are the solution heat exchanger, the absorber and the evaporator. In addition, the relationship between absorber, steam generator and condenser and the low-temperature generator was established and the conditions for obtaining the minimum value for the sum of the heat transfer areas were studied.

13657 **Field measurements of light shelf performance in a major office installation.** Benton, C.; Erwine, B.; Warren, M.; Selkowitz, S. (Lawrence Berkeley Lab., Berkeley, CA 94720). pp 290 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

Electric lighting is a major component of electrical energy use in large commercial buildings and has additional significant impact on the cooling energy requirements. This paper evaluates

the monitored performance of such an integrated lighting scheme in a recently completed 600,000-ft2 office structure located in the San Francisco Bay Area. Decentralized data acquisition systems monitored 62 different locations in the building between May 1985 and January 1986, recording average illuminance levels and corresponding ambient lighting power usage across the north and south building sections. A graphic summary of data compares the performance of effectiveness of the building's lightshelf system for north and south orientations. One counterintuitive conclusion of the study is that the "dimmer" north side light shelf scheme exhibits a higher potential (69% reduction from full power) for electric light reduction than the "brighter" south side scheme (56% reduction).

13658 **Internal edge losses in glazing solar radiation transmission calculations.** Burch, J.D. (Solar Energy Research Institute, Golden, CO 80401). pp 124-129 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

One mechanism not generally explicitly modeled by microdynamic building energy simulations is the internal edge loss, due to radiation impinging on the glazing assembly supports that are positioned between the outside pane and the interior. In this paper, expressions are derived to allow a modeler to account for this mechanism by modifying the literal inputs describing the glazing. In general, edge losses should be considered when the width of the internal edge becomes a significant fraction of the window characteristic width, such as in superinsulated sections.

13659 **Intrinsic advantages of macrodynamics for building energy analysis.** Subbarao, K.; Burch, J.; Christensen, C. (Solar Energy Research Institute, 1617 Cole Boulevard, Golden, CO 80401). pp 82-87 of Proceedings of the 11th national passive solar conference. Volume II. New York, NY; American Solar Energy Society (1986). (CONF-860655—).

From American Solar Energy Society annual meeting and 11. national passive solar conference; Boulder, CO, USA (8 Jun 1986).

Dynamic building thermal models are needed in design and monitoring applications for low-energy, innovative buildings, and can be classified as "microdynamic" or "macrodynamic." The basic concept of a microdynamic simulation (e.g., DOE2.1, BLAST3) is that, given a "microscopic" description of the building (material properties, detailed geometry, etc.) and using known laws of nature, one can determine the building performance by simulating all energy fluxes in each element in the description. Advantages of this approach include potential generality and its ability to handle nonlinear processes. The premise for macrodynamics is that building response to driving functions can be characterized by only a few, aggregated parameters (e.g., the well-known steady-state building load coefficient). The building parameters can be obtained either by calculation or measurement, allowing data and theory to be balanced. Advantages of macrodynamics over the more familiar microdynamics are: (1) for design: there is a clear intuitive link between the few descriptive parameters and performance, and (2) for monitoring: the building parameters are uniquely obtained from focused short-term tests.

13660 **The use of DOE-2 to evaluate the energy performance of buildings.** Curtis, R.B.; Birdsall, B.; Buhl, W.F.; Erdem, E.; Eto, J.; Hirsch, J.J.; Olson, K.H.; Winkelmann, F.C. pp 1-29 of Proceedings of the ASEAN conference on energy conservation in buildings. Olson, K.H.; Wong, W.C. Singapore, Singapore; ASEAN (1984). (CONF-8405264—).

From ASEAN conference on energy conservation in buildings; Singapore, Singapore (1 May 1984).

The DOE-2 Building Energy Analysis Program was the computer simulation program employed in the analysis of energy conservation in ASEAN buildings. The program was designed to assist engineers and architects in the performance of design studies of whole-building energy use under actual weather conditions. Its development was guided by several objectives: 1) that the description of the building entered by the user be readily understood by non-computer scientists, 2) that, when available, the calculations be based upon well established algorithms, 3) that it permit the simulation of commonly available heating, ventilating, and air-conditioning (HVAC) equipment, 4) that the computer costs of the program be minimal, and 5) that the predicted energy use of a building be acceptably close to measured values. These objectives have been met. This paper is intended to give an overview of the DOE-2.1C version.

3202 Transportation

REFER ALSO TO CITATION(S) 13724

13661 **(LA-UR—86-4296) Fuel cells in transportation.** Huff, J.R.; Murray, H.S. (Los Alamos National Lab., NM (USA)). Jan 1987. Contract W-7405-ENG-36. 8p. (CONF-870111—2). NTIS, PC A02/MF A01. File Number DE87003746.

From Annual battery conference on application and advances; Long Beach, CA, USA (13 Jan 1987).

Fuel cells have been considered for use in transportation applications for a number of years. They are attractive because they offer a mode of reducing US dependency on petroleum. Fuel cell performance at present has been assessed for applicability to vehicle power plants. Types of fuels that might be used and their effect on selection of a fuel cell technology have been considered. Simulation of a city bus using a hybrid fuel cell/battery power plant indicates that adequate performance can be obtained with current technology.

13662 **(NP—7751256) Development of a one-piece plastic front end.** Brueck, K.H. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.)). Mar 1986. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751256.

Aerodynamics, aesthetics, creativeness and integration of parts are the essential criteria to be encouraging and speeding the future use of plastics in automotive engineering. The paper abstracted gives a survey of the planning and fabrication of a one-piece plastic automotive front part. The introduction is dedicated to a historical survey of developmental trends in Europe and the USA. It is followed by a description of the idea developing into the final concept. Moreover, the paper points out front end requirements and overall conception requirements and discusses cost and weight analyses. A description is given of the development and realization of master patterns and moulded parts as well as of the analysis of possible design and materials alternatives. The final chapter is dedicated to materials recovery, recycling and reusable products. It also points out problems of the economic coating of plastic shells.

13663 **(PB—87-100830/XAB) International Committee on Traffic Conflict Techniques (ICTCT) calibration study at Malmo: a quantitative analysis of video recordings.** van der Horst, A.R.A. (Institute for Perception RVO-TNO, Soesterberg (Netherlands)). Dec 1984. 43p. (IZF—1984-37). NTIS, PC PC E03/MF E01.

To investigate a number of Traffic Conflict Techniques, three intersections at Malmo (Sweden) were studied by observer teams of eight countries while simultaneous video recordings were made. This set was analyzed quantitatively from video in order to get an objective description in terms of speed, deceleration, minimum distance, time-to-collision (TTC), and post-encroachment time (PET). The minimum TTC appeared to be the most important variable in explaining a common severity scale, but not the only one. Conflict type contributes substantially to the prediction of severity. Comparisons were made between calculated and estimated measures, like TTC for Sweden and Finland and PET for Canada.

13664 **(PB—87-102885/XAB) Energy conservation and cost savings related to highway routine maintenance. Executive Summary (revised). Final report.** Saito, M.; Sharaf, E.A.; Sinha, K.C. (Purdue Univ., Lafayette, IN (USA). Joint Highway Research Project). 10 Jul 1986. 31p. (JHRP—85-18-ES). NTIS, PC A03/MF A01.

The study focused on a trend analysis of energy use in routine maintenance and development of an optimization approach that

can be used to determine the optimal assignment of various equipment types to different activities. The use of the approach was illustrated through an example application. A set of energy-conservation guidelines was then outlined for possible implementation.

13665 **(PB—87-102893/XAB) Energy conservation and cost savings related to highway routine maintenance (revised). Final report.** Saito, M.; Sharaf, E.A.; Sinha, K.C. (Purdue Univ., Lafayette, IN (USA). Joint Highway Research Project). 10 Jul 1986. 158p. (JHRP—85-18). NTIS, PC A08/MF A01.

The report includes a summary of the first two phases and a detailed discussion of the final phase. The final phase of the study focused on a trend analysis of energy use in routine maintenance and development of an optimization approach that can be used to determine the optimal assignment of various equipment types to different activities. The use of the approach was illustrated through an example application. A set of energy-conservation guidelines was then outlined for possible implementation.

13666 **(PB—87-103347/XAB) Taxi-based paratransit technology/operations packages in Europe. Final report.** (Multiplications, Inc., Cambridge, MA (USA)). May 1985. 134p. NTIS, PC A07/MF A01.

The report describes a new generation of dispatching systems emerging in Europe that link a central taxi dispatching service to all vehicles in the fleet through computerization and digital communications. The actual matching of customers with particular taxis and sending of the cab is left to the systems computer. The document provides an overview of the evolution of these advanced taxi dispatching systems, and how such systems operate, both from the perspective of users and of the taxi drivers. The various European technologies available for these functions are reviewed: the factors that originally led to their development, their actual on-street deployment and operations, and the specific factors that make each approach unique. The cost of implementation and potential benefits in terms of improved taxi service and economics are covered. The document also explores how to plan and implement a new operation or upgrade an existing manual one. The European approaches appear fully transferable to U.S. taxi systems.

13667 **(PB—87-103552/XAB) Use of microcomputers at North Country Transit District. Technical assistance report.** (Multiplications, Inc., Cambridge, MA (USA)). Jun 1984. 42p. NTIS, PC A03/MF A01.

The report describes the process used to explore options for upgrading the use of computers at the North County Transit District in Oceanside, California. The report first describes the original computer applications of the transit operator. It then explores changes and enhancements to these functions, as well as new areas for microcomputer application. The document emphasizes five key areas: financial application, personnel applications, maintenance applications, operations application, and planning and marketing applications. The document also includes material describing hardware necessary to implement the desired system, as well as required types of software packages. The recommendations are specific to North County, but the process used to develop them should be generally applicable. The report should be especially interesting to the management of small- and medium-size transit systems.

13668 **(PB—87-103891/XAB) Transit planning in metropolitan Seattle: a historical perspective. Final report.** Malm, R. (Washington Univ., Seattle (USA). Dept. of Civil Engineering). Apr 1986. 71p. NTIS, PC A04/MF A01.

The document provides a historical overview of trends in transit planning to casing on the experiences of Seattle, Washington as a case study. It focuses on the period from the 1940's to the present, detailing major transit initiatives and the planning process which led to them. The document includes a detailed chronological review of events affecting transportation planning, both in Seattle and nationwide.

13669 **(PB—87-116752/XAB) Transit bus maintenance management.** Andrle, S.J.; Zimmerman, J.F.; Duffy, J.; Foerster, J.F.; Puente, S. (National Research Council, Washington, DC (USA). Transportation Research Board). 1986. 70p. (TRB/TRR—1066). NTIS, PC A04/MF A01.

Library of Congress catalog card no. 86-21861.

The 8 papers in the report deal with the following areas: some recent developments in summary; research needs in transit-bus maintenance; transit-bus maintenance in New York State; issues and analysis; management of transit-bus prerun inspections; application of a transit-maintenance management-evaluation procedure; analysis of bus transit's maintenance efficiency using section 15 data; climatic effects on bus durability; exploring the multiple factor concept for bus maintenance using simulation; effectiveness of improved repair scheduling in the performance of bus-transit maintenance.

13670 **(PB—87-118287/XAB) Guide to innovative financing mechanisms for mass transportation: an update.** (Rice Center, Houston, TX (USA)). Dec 1985. 108p. NTIS, PC A06/MF A01.

The document provides an overview of nonstandard techniques currently being used to finance transit capital and operating expenses. An update of a study, the report focused on six types of mechanisms: assessments, taxes and user charges, use of property and property rights, issuance of debt, contracted services, and voluntary participation programs. A new section, Initiatives and Ideas, discusses local funding of community services like Montgomery County, Maryland's Ride On, franchise approaches, and nonsubsidized bus and vanpool services. The report is structured in two independant parts: the first describes the theoretical background of each technique, and is keyed to a second part, which describes typical applications of the mechanism.

13671 **(PB—87-120804/XAB) Urban transportation planning in the United States: an historical overview (revised edition).** Weiner, E. (Department of Transportation, Washington, DC (USA). Office of the Assistant Secretary for Policy and International Affairs). Feb 1986. 159p. NTIS, PC A08/MF A01.

The report describes the evolution of urban transportation planning in the country over the last fifty years. It is an update and revision to a report originally issued in mid-1983, and adds material covering the period through the end of 1985. It reviews the full range of technical and non-technical issues associated with the planning process including planning procedures, relevant legislative initiatives, regulations, and transportation technology itself. Specific changes in the new edition include a restructuring of the material in the document dealing with urban economic revitalization, coverage of the implementation of the new urban transportation planning regulation and addition of a new section on private sector participation. The document also includes a new chronology of significant events in transportation planning and a list of abbreviations and acronyms as new appendices. It should be particularly interesting to those desiring an overview of the planning process, and practicing planners themselves.

13672 **Vehicle stock modelling of highway energy use. Tunisian and US applications.** Greene, D.L.; Meddeb, N.; Liu Jintan. (Oak Ridge National Lab., TN, USA; Societe de Matrise de l'Energie, Tunis, TN; Vanderbilt Univ., Nashville, TN, USA). *Energy Policy;* **14**: No. 5, 437-446(Oct 1986).

Road transport is the major petroleum-using sector in many developing countries. Influencing the size and efficiency of the vehicle stock is probably the most important area of energy policy for transport. A model of vehicle stock evolution suitable for estimating the effects of policies directed at efficiency improvements, the volume of new registrations and fuel substitution is described and illustrated by a projection of light trucks in Tunisia and an analysis of hypothetical conservation and fuel-switching initiatives. The transferability of the model is demonstrated by an estimation of fuel savings due to automobile fuel economy gains since 1975 in the USA. The present value of savings is put at $92 billion (1984 $).

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 13444, 14277

13673 **(AD-A—173434/2/XAB) Study of waste-heat-boiler size and performance of a conceptual marine COGAS system. Research and development report.** Muench, R.K.; Knauss, D.T.; Purnell, J.G. (David W. Taylor Research and Development Center, Bethesda, MD (USA)). Feb 1980. 31p. (DTNSRCD-TM—27-80-19). NTIS, PC A03/MF A01.

The effect of waste-heat-boiler weight and volume on the performance of an LM2500-based combined gas and steam turbine system (COGAS) is examined. The boiler is a once-through type which is controlled to extract the maximum heat from the gas turbine exhaust and still maintain acceptable minimum wall temperature. At a gas turbine power of 12,000 hp (8.95 MW), the boiler without feed-water heating can produce sufficient steam to generate 2840 hp (2120 kW) at a turbine efficiency of 80%. This boiler, including diffuser, weighs 19,300 lbs (8770 kg) and has a gas side pressure drop of 9 in. H2O (2.2 kPa). With feed-water heating, the steam power can be increased to 4000 hp (2980 kW) with a boiler weight of 38,300 lbs. (17,400 kg). The 24 and 33% respective increases in power for these two systems at cruise are translated to 15 and 20% improvement in fuel consumption over the LM2500 gas turbine at the higher power levels of the COGAS system. At the lower power levels, both COGAS systems yield a 20% improvement in fuel consumption over the basic gas turbine.

13674 (CONF-8511246—, pp 212-218) **Development of a process to utilize waste heat from a blast furnace and hot strip facility of the Thyssen Stahl AG for district heating.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The waste heat of exhaust gases from the blast heating plant of a blast furnace is utilized for district heating purposes by the integration of heat exchangers in the consisting exhaust gas channels. The heat exchanger set consisting of steel finned tubes is directly placed in the waste gas channel. Corrosion problems of the heat exchanger and the problems of the variable heat delivery of the exhaust gases are discussed. (HGOE).

13675 (CONF-8511246—, pp 219-227) **Waste heat utilization from a sulfuric acid plant.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The absorption heat of the sulfuric acid production is recovered by hot absorption at 85/sup 0/C at a higher temparature level than usual and delivered to a district heating system. The waste heat recovery is carried out in three consecutive steps (absorptions with about 6.9, 8.8 and 7.0 gcal/h). Cooling tanks with teflon inner coatings and acid-resistant lining against corrosion were used as heat exchangers. Operational experiences from test operation are given. (HGOE).

13676 **(DOE/CE/40699—T6) Energy conserved and costs saved by small and medium-size manufacturers: 1984-85 EADC [Energy Analysis and Diagnostics Center] program period.** Perrotti, G.M.; Johnson, J.H.; Kirsch, F.W. (University City Science Center, Philadelphia, PA (USA). Center for Energy Management and Industrial Technology). Jan 1987. Contract FC01-84CE40699. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004382.

Results indicate that manufacturers have confidence in the EADCs' recommendations and are rewarded by improved competitiveness for their products and processes. When the government strengths manufacturers' confidence by providing needed information effectively, the results can be highly beneficial to the manufacturers, to the government, and to the nation as a whole. This report also presents a detailed examination of the energy conservation and savings recommended during 1984-85 by the EADCs and implemented by the manufacturers according to the energy sources affected, the categories of energy use in the plants (e.g., production of services), the types of ECOs considered, and the industries (SIC codes) into which the plants are classified.

13677 **(DOE/OR/00033—T264) The role of electricity in American industry: Update.** Burwell, C.C. (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1985. Contract AC05-76OR00033. 30p. NTIS, PC A03/MF A01. File Number DE87004892.

Between 1960 and 1982 US industry reduced its use of energy by 41% for each unit of output. This astonishing increase in energy efficiency was accompanied by an equally notable trend. Over that same period, while energy use dropped, the amount of electricity needed per unit of industrial output actually increased by almost 10%. These two phenomena - reduced energy consumption and increased electricity consumption - point to an important trend that has been generally overlooked in energy analyses: the continuing electrification of US industry. The prospects for increased electrification are substantial. There are a variety of economic, productivity, and environmental advantages to the use of electricity in various process industries. For example, processing industries such as glass-making, primary metals production, chemicals, pulp and paper, and petroleum refining are making major changes toward increased electrification and associated improvements in overall energy efficiency, productivity, and economic competitiveness. Since the process industries are not labor-intensive, further electrification is unlikely to introduce unemployment problems. In fact, it is probable that the increased use of electricity in the future will actually increase job opportunities in the areas of electric generating station construction and electric equipment manufacture and maintenance.

13678 **(ENV-MER—81-138) Research on the behaviour of polluting industrial wastes in insulated discharges.** Navarro, A.; Revin, P.; Nicole, J. (Ministere de l'Environnement et du cadre de vie, 92 - Neuilly (France)). Mar 1983. 151p. (In French). NTIS (US Sales Only), PC A08. File Number DE87750948.

Industrial effluents discharge, alone or combined to domestic garbage, have been tested in order to be able to predict evolution of the wastes as a function of time and meteorological parameters, but also to prevent synergetic processes or incompatibility with other effluents. On field and laboratory tests were performed with grinding sludges, emulseri (hydrocarbon muds), sulphuric tars, phenoled sludges, cyanide hardening salts, and town refuses. Comparison between effluents behaviour when alone or combined with domestic effluents, correlation between rain regime and leachate quantities, duration of the pollution, evolution of the leachate concentration were studied.

13679 **(EUR—9850) Design of waste heat boilers for the recovery of energy from arc furnace waste gases.** Dixon, J.; Bramfoot, S. (Commission of the European Communities, Luxembourg). 1985. 61p. Commission of the European Communities, Luxembourg.

Various practical implications of the use of a waste heat boiler have been studied. These include the location of the boiler, the accretion of solid matter on tubes, the effect of the presence of the boiler on gas cleaning and the control of furnace extraction to achieve optimum performance. The economics of using a waste heat boiler on a 180 t furnace to supply part of the steam demand from a works producing special steels have been examined. Payback periods of between 1.7 and 2.9 years according to the fraction of the load supplied are indicated. The rate of return on investment is forecast to be in the range 33-58%. The use of waste heat steam to generate electricity is not attractive under present circumstances unless generating capacity already exists. This conclusion applies to a large user of energy in the UK; the economics could be more favourable in other EEC countries where different tariff structures and energy price relativities pertain.

13680 **(EUR—9918) Research programme on efficiency of reverberatory furnaces.** Subramanian, V.; Bunting, J.G.; Gill, D.J.; Hannah, A.; Mistry, C.D. (Commission of the European Communities, Luxembourg). 1985. 113p. Commission of the European Communities, Luxembourg.

This research programme covered a three-year programme that was conceptually divided into three stages of development. The objective was to achieve substantial fuel savings (target of 15%) in aluminium reverberatory and holding furnaces which were typical of that industry. Stage I was the application and assessment of instrumented manual controls. Stage II was the progression through to automated control analogue system based on single-loop control. Stage III was the development of appropriate equipment to implement fully automated, multi-loop control. Four furnaces were selected from within the British Aluminium (BA) group of companies. A fifth furnace was later chosen to supplement Stage III application. These furnaces were considered typical of the efficiencies throughout the industry i.e. 10-25%. The initial approach was to conduct a preliminary survey of furnace operations and the combustion systems, whereupon modifications were carried out to improve operation, furnace efficiency and the monitoring of furnace status.

13681 **(NP—7751166) Production and energy consumption of small and medium-scale production plants - fruit-juice production and bottling plants in Baden-Wuerttemberg. Instructions for evaluating energy conservation potentials. Working paper.** Mielicke, U. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung). Jul 1985. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87751166.

The effective operation of small and medium-scale industrial plants essentially depends on their making use of individual, specific information on energy consumption, production-specific energy consumption, the compilation and evaluation of energy data as well as on organizational measures and energy conserving engineering. Successful energy conservation presupposes individual energy analysis as well as the comparative evaluation of the results obtained with practical energy consumption and the assessment of components and processes consuming most of the energy available by way of exact measurement, testing and adequate concepts. The publication abstracted gives a description of the operational structures and technical equipment typical of both a small and a medium-scale fruit-juice production and bottling demonstration plant. It points out the respective energy consumption/energy flows as well as the crucial sources of energy consumption. The demonstration plants' specific energy consumption of individual process cycles calculated from their overall energy consumption serves as the basis of calculating the theoretical consumption of a plant assuming an optimal energetic design. A comparative evaluation of theoretical and actual energy consumption allows a rough provisional statement of the plant's energy conserving potentials. As theoretical data do not reflect the ideal case they leave a margin for further potentials. These, however, do as a rule go hand in hand with considerable investments.

13682 **(PB—87-116992/XAB) Bureau of Mines research on recycling scrapped automobiles.** Dean, K.C.; Sterner, J.W.; Shirts, M.B.; Froisland, L.J. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1986. 54p. (BM-B—684). NTIS, PC A04/MF A01.

Library of Congress catalog card no. 85-600277.

Discarded automobiles represent the greatest single resource of reusable metals, plastics, and rubber in the United States. The report presents results of Bureau of Mines research, conducted from 1965 to 1983, on separating and recovering useful materials from the scrapped hulks, using old and new metallurgical techniques combined with standard scrapyard methods. The Bureau determined the materials composition of three composite cars designated as circa 1960, mid-1970's, and early 1980's, and used these cars to study smokeless incineration and hand-sorting techniques.

13683 **(PB—87-119392/XAB) Citrate process for flue-gas desulfurization. Bulletin.** Nissen, W.I.; Crocker, L.; Oden, L.L. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1986. 78p. (BM-B—686). NTIS, PC A05/MF A01.

Library of Congress catalog card no. 85-600312.

As part of its program to provide technology for reducing undesirable environmental impacts of mineral-processing operations, the Bureau of Mines developed the citrate process for desulfurizing industrial stack gases that contain from 0.1 to 2 vol pct SO_2. In this regenerable flue-gas desulfurization process, SO_2 is absorbed from cleaned and cooled industrial flue gas with a citric acid-sodium citrate solution. The absorbed SO_2 is subsequently reacted with H_2S to precipitate marketable elemental sulfur and regenerate the solution for recycle. The bulletin describes the citrate process and gives results of the laboratory, pilot plant, and demonstration plant studies, as well as corrosion investigations.

13684 **(PB—87-129268/XAB) Ferroalloy industry particulate emissions: source category report. Final report, June 1984-August 1986.** Limberakis, E.J.; Vay, J.; Gronberg, S. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Nov 1986. 107p. NTIS, PC A06/MF A01.

The report gives results of a review of all available data characterizing particulate emissions from ferroalloy-producing electric arc furnaces. The data were summarized and rated in terms of reliability. Total and size-specific emission factors were developed for the ferroalloy industry. The ferroalloy industry and furnace operation are described in detail, with emphasis on factors affecting emissions. A replacement for Section 7.4, Ferroalloy Production, in AP-42 was prepared which includes size-specific emission factors.

13685 **(PB—87-133468/XAB) Simplified volatile organics sampler. Final report, December 1984-December 1985.** James, R.H.; Bryant, M.L.; Adams, R.E.; Miller, H.C. (Southern Research Inst., Birmingham, AL (USA)). Nov 1986. 59p. (SORI-EAS—86-208). NTIS, PC A04/MF A01.

This report describes the results of a task-supporting EPA in its efforts to license hazardous-waste incinerators. The study provided a design for a simplified sampling system for medium levels of volatile organic compounds (VOCs). Most of the study involved evaluation of sorbents and mixed-sorbent sampling tubes to develop a rugged, compact VOC collection system. The report describes the evaluation of sorbent materials, the development of a sampling tube, and the laboratory evaluation of the sampling system with several VOCs. The simplified sampling system consists of a single tandem-bed sorbent tube containing Tenax GC and Spherocarb sorbents. Direct thermal desorption into a GC/FID or GC/MS provides a rugged and simple sampling and analysis system.

13686 **(PB—87-140885/XAB) Mobile laboratory for on-site monitoring of hazardous-waste incinerators. Final report, April 1985-September 1986.** Nolen, S.L.; Jackson, M.D.; Harris, D.B. (Acurex Corp., Research Triangle Park, NC (USA)). Nov 1986. 35p. NTIS, PC A03/MF A01.

The report discusses: the development of EPA's Hazardous Air Pollutants Mobile Laboratory (HAPML), equipped with monitors for on-line analysis of inorganic and organic stack gas emissions and instrumentation including a gas chromatograph and mass spectrometer (GC/MS); results from the first field test and other combustion sources; and plans for the future. The EPA has increasingly viewed incineration as an effective means of destroying hazardous waste. Incinerators are permitted - via a detailed trial burn under the Resource Conservation and Recovery Act - to burn hazardous waste. These incinerators are then operated using CO and other process parameters established during the trial burn to determine compliance. Because of the interest in monitoring the performance of incinerators on a real-time basis and the need to characterize emissions from a variety of incinerators, the EPA built the HAPML for real-time and near real-time monitoring of hazardous-waste-incinerator emissions and operating parameters.

13687 **(PB—87-140935/XAB) Nonferrous industry particulate emissions: source category report. Final report, June 1983-August 1986.** Burnett, M.; Minden, A. (Acurex Corp., Mountain View, CA (USA)). Dec 1986. 256p. NTIS, PC A12/MF A01.

The report gives results of the development of particulate-emission factors based on cutoff size for inhalable particles for the nonferrous industry. After a review of available information characterizing particulate emissions from nonferrous plants, the data were summarized and rated in terms of reliability. Size-specific emission factors were developed from these data for the major processes used in the manufacture of nonferrous metals. A detailed process description is presented with emphasis on factors affecting the generation of emissions. There were replacements for Sections 7.1 (Primary Aluminum Production), 7.3 (Primary Copper Smelting), 7.6 (Primary Lead Smelting), 7.7 (Primary Zinc Smelting), and 7.11 (Secondary Lead Smelting) of EPA report AP-42. A Compilation of Air Pollutant Emissions Factors, was prepared, containing the size-specific emission factors developed during the program.

13688 **(PB—87-142493/XAB) High-temperature burner with heat exchanger. Final report, 15 March 1984-14 July 1985.** Davies, T.; Bowers, J. (North American Mfg. Co., Cleveland, OH (USA)). Jul 1985. 47p. NTIS, PC A03/MF A01.

Color illustrations reproduced in black and white.

The report describes the second year and final quarter development of both radiant tube and direct-fired burners that have regenerators in their construction for heat recovery. Development has involved not only the burners but also control systems including actuators, valves and controls.

13689 **Energy conservation savings by US industry.** Wilfert, G.L.; Roop, J.M. (Pacific Northwest Labs., Richland, WA). *Strategic Planning and Energy Management;* **6**: No. 2, 35-50(1986). Contract AC06-76RL01830.

The traditional industrial production/energy consumption lockstep relationship was broken in 1974, and has continued a trend toward more energy efficiency. Using a simple regression model, the authors find two primary forces at work: a change in the mix of US industrial products and improvements in industrial energy-use efficiency. Shifts in consumer preferences, shifts to less energy-intensive intermediate materials, and shifts in production to offshore sites for some products are the main causes for the change. New technology and manufacturing facilities will open even larger opportunities for energy savings in the future even if energy prices continue to decline. 10 references, 3 figures, 2 tables.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 13125, 13126, 13127, 13348, 13431, 13432, 13433, 13436, 13599, 13600, 13601, 13602, 13639, 13651, 13678, 13685, 13686, 14015

13690 **(AD-A—173657/8/XAB) Basic system description for coal gas/fuel cell/cogeneration project.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). 29 Jan 1985. 112p. NTIS, PC A06/MF A01.

This facilities planning project is the first major step in a demonstration program developed and proposed by Georgetown University and Ebasco Services Incorporated to install coal gas/fuel cell/cogeneration (GFC) systems to service Department of Army (DOA) sites. The objective is to perform analysis of four sites to determine if the system will lead to increases in energy efficiency, higher conservation standards, and economic benefits sufficient to attract third-party equity investment to offset a significant portion of the funds required from the DOA.

13691 **(AD-A—173684/2/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Fort Greely, Alaska site. Preliminary survey.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). 2 Apr 1985. 24p. NTIS, PC A02/MF A01.

This report presents the results of the preliminary survey of the Fort Greely, Alaska site proposed for a coal gasification/fuel cell/gogneration (GFC) system. The site characteristics that could effect the feasibility of a GFC installation are discussed as well as existing methods for generating and distributing thermal and electric energy.

13692 **(AD-A—173685/9/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Washington, DC site. Preliminary survey.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). Jun 1985. 22p. NTIS, PC A02/MF A01.

This report presents the results of the preliminary survey of the Washington D.C. site proposed for a coal gasification/fuel cell/cogeneration (GFC) system. The site characteristics that could affect the feasibility of a GFC installation are discussed as well as existing methods for generating and distributing thermal and electric energy.

13693 **(AD-A—173686/7/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Fort Hood, Texas site. Preliminary survey.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). Jun 1985. 19p. NTIS, PC A02/MF A01.

This report presents the results of the preliminary survey of the Fort Hood, Texas site proposed for a coal gasification/fuel cell/cogeneration (GFC) system. The site characteristics that could affect the feasibility of a GFC installation are discussed as well as existing methods for generating and distributing thermal and electric energy.

13694 **(AD-A—173689/1/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Scranton, Pennsylvania site. Project description.** Rossi, B.; Estreich, P. (Ebasco Services, Inc., New York (USA)). Nov 1985. 204p. NTIS, PC A10/MF A01.

This report is to describe a coal gasification/fuel cell/cogeneration (GFC) project that is specific to the Scranton Army Ammunition Plant (AAP) in Scranton, Pennsylvania. The project at this site, as with those at the three other sites selected for this program, is intended to demonstrate the technical, economic, and financing viability of power generation by fuel cells using gas from coal. The specific design described is based on a Westinghouse Corporation nominal 7.5-MW fuel cell with local anthracite coal fed to the gasifier. Mass and energy balances have been prepared for the gasification, gas processing, fuel cell, and thermal management systems using locally available anthracite design coal.

13695 **(AD-A—173690/9/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Fort Hood, Texas site. Project description.** Rossi, B.; Estreich, P. (Ebasco Services, Inc., New York (USA)). Jul 1985. 218p. NTIS, PC A10/MF A01.

This report describes a coal gasification/fuel cell/cogeneration (GFC) project that is specific to the Fort Hood, Texas site. The project at this site, as with those at the three other sites selected for this program, is intended to demonstrate the technical, economic, and financing viability of power generation by fuel cells using gas from coal. Mass and energy balances were prepared for the gasification, gas processing, fuel cell, and thermal management systems using a Texas lignite as the design coal.

13696 **(AD-A—173692/5/XAB) Feasibility study of coal gasification/fuel cell cogeneration. Preliminary site survey - Scranton, Pennsylvania. Survey report.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). 11 Mar 1985. 20p. NTIS, PC A02/MF A01.

This report presents the results of the preliminary survey of the Scranton, Pennsylvania site proposed for a coal gasification/fuel cell/cogeneration (GFC) system. The site characteristics that could affect the feasibility of a GFC installation are discussed as well as existing methods for generating and distributing thermal and electric energy.

13697 **(AD-A—173741/0/XAB) Feasibility study of coal gasification/fuel cell/cogeneration project, Washington, DC site. Project description.** Trapp, C.; Estreich, P. (Ebasco Services, Inc., New York (USA)). Jun 1985. 207p. NTIS, PC A10/MF A01.

The purpose of this report is to describe a coal gasification/ fuel cell/cogeneration (GFC) project that is specific to the Georgetown University site in Washington, DC. The project at this site, as with those at the three other sites selected for this program, is intended to demonstrate the technical, economic, and financing viability of power generation by fuel cells using gas from coal. Mass and energy balances were prepared for the gasification, gas processing, fuel cell, and thermal-management systems using an eastern Kentucky bituminous coal, selected for its low tendency to cake in the gasifier bed.

13698 **(BMFT-FB-T—86-089) Primary energy saving energy supply of the BBW Lingen-Ems by utilization of natural heat sources and operation of a small heating power station. Final report.** Jensch, W.; Werning, L.; Mueller, P.; Gunia, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 178p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87751156.

It was the aim of the project to show the chances and limits of the use of block heating power stations (BHKW) for the rational electricity and heat generation. In order to cover the energy demand the components gas boiler, electric heat pumps, waste heat utilization/electricity generation of one's own with BHKW and procurement of electricity from outside generators were used. In the frame of a system analysis, these components were varied with respect to their share concerning the total energy supply and were evaluated according to the criteria with respect to power economy. The controlling value for the operation of the BHKW is 1. the electric power and 2. the heat demand. During a space of two heating periods, all important data were recorded in a measuring program and energy balances were established for the partial components and the whole supply system. The experiences with the plant being in operation since November 1981 have shown that beside a high degree of supply safety primary energy savings of more than 25% can be reached. With regard to certain points given which are explained in the report an economic operation is possible with this plant conception. With 30 tabs., 69 figs.

13699 (CONF-8511246—, pp 157-172) **Development of a modular district heating system on the basis of large heat pumps driven by spark ignition engines.** Zacharias, F. (Motoren-Werke Mannheim A.G., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

By optimization of a few function groups an optimum and fulfillment-economic of the demands to a heat pump district heating system could be achieved. For this purpose the computer simulation of the correlation of the heating station and the consumers and the exact and quickly predetermination of the rotational swinging behaviour of an internal combustion engine-compressor-generator plant was considered. Further developments of the engine-compressor aggregate, the engine-waste heat unit with a three-way catalyst, the thermo-acoustic capsule for the gas engine and the building module were carried out. (HGOE).

13700 (CONF-8511246—, pp 173-181) **Adsorption-type heat pump at Waiblingen sewage treatment plant. Use of waste heat from sewage and sewage gas for district heating purposes.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The combination of a directly gas-fired water-water-absorption heat pump with two conventional gas boilers with sewer gas as the fuel has been applied for the heating energy recovery from waste water of a sewage plant by using sewer gas. Operational experiences with this plant are presented. Besides of an important contribution for the primary energy the emission values have been improved essentially by the use of the absorption heat pump and gas firing instead of the consisting single oil heating plants. (HGOE).

13701 (CONF-8511246—, pp 183-193) **Non-polluting optimized cogeneration plant and propulsion for a gas heat pump by means of a lean mixture.** Dietrich, W. (Motoren-Werke Mannheim A.G., Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

A gas engine-heat pump heating station with a connected district heating network has been projected for an urban region. The entire project consists of the main components gas engine-heat pumps with reciprocating compressors, gas heating station, storage facilities and district heat network. The heat pumps utilize river water as the "cold heat source" and as refrigerant "R 12". (HGOE).

13702 (CONF-8511246—, pp 202-211) **Energy-saving heat supply system for Lingen Vocational School - utilization of natural heat sources and operation of a small heat- and-power station.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

A system for the heat supply of a professional training center has been carried out by taking into account the need for electrical energy. As a result of this investigation a combination of three small heating stations and eight air/water heat pumps and two gas boilers were erected. By this means a primary energy saving of about 17.9% could be achieved. (HGOE).

13703 (CONF-8511246—, pp 228-231) **Development of district heat transport without pipelines - container transport of district heat.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The heat from heating stations or any waste heat sources is transferred to a heat transfer fluid (thermo oil) in a large tank, transported to the consumer and transferred there by heat exchangers from the heat transfer fluid to the consisting supply system. The heat transport by truck has been tested with mineral oil maximally heated to 320/sup 0/C and by this means the principle and the technical system have been proven to be efficient. The criterions of the economy of this system are given. (HGOE).

13704 (CONF-8511246—, pp 232-239) **Development of a vacuum-insulated district heat pipe.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The usability of vacuum isolated for district heating pipelines has been investigated by means of the mechanical stress of the inner pipe, the heat losses particularly in the joint region, the manufacturing processes and the constructive design of formed peaces of the joints between two district heating pipes. The thermal analysis of the pipes is presented. The filling of the evacuated space between the inner and the outer pipe with kieselguhr and the evacuation process are discussed. An economy calculation is presented. (HGOE).

13705 (CONF-8511246—, pp 240-250) **Comparison of different laying systems for district heat-transport pipelines.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The most important pipelaying systems for district heat transportation (channel laying, exterior pipe, vacuum steel jacketed, plastic and asbestos cement jacketed systems) are compared according to the investment and operation costs depending on the most important variables. Particularly the heat loss at district heating pipelines at consisting networks have been analysed by the method of integral heat loss amounts. Mathematical models for the prediction of heat losses at different piping systems are given. (HGOE).

13706 (CONF-8511246—, pp 251-258) **Thermal insulation of vacuum jacketed steel pipes for district heating pipelines.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

Investigations about the heat loss and temperature pattern in roller bearings and intermediate fixed points at vacuum jacketed steel pipes were carried out in order to obtain results for a model description of heat transport phenomena. Frigen was introduced into the gas space of the isolating material and fiber flocks were used as the isolating material in order to improve the thermal insulation with vacuum. In both cases a better heat insulation could be achieved. (HGOE).

13707 (CONF-8511246—, pp 268-283) **Flexible, oxygen-tight heat transfer system out of plastics.** Hanisch. 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

A system developed for the transport of the heating medium in district heating pipelines consists of inner tube exposed to thermal and mechanical load which is surrounded by a mechanically loadable but sufficiently flexible polymer in order to lower termal losses. The inner piping has been prepared but of cross-linked polyethylene with high density and diffusion sealing. The thermal isolation layer consists of polyurethane. It is also reported about the junction technique for the polymer pipings. (HGOE).

13708 (CONF-8511246—, pp 284-292) **Welding of water-filled pipes for the drilling and repair of district heating pipelines.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The results of welding experiments at filled-up heating water pipings have shown that perfect weldings can be carried out for maleing new connections and repairs at pipings without operational delay. Welding technical investigations and mechanical tests have been carried out presenting the basis for the evaluation of the quality of the seam weld. The interpretation enables to evaluate the mechanical strength of the different solutions. (HGOE).

13709 (CONF-8511246—, pp 293-304) **Pressure loss and heat transfer in district heating pipelines after addition of anti-attrition agents.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The resistance and heat transfer reducing effect of micellar frictional reducers were investigated by means of laboratory experiments. The reduction of the heat transfer up to 1/15 and the frictional pressure losses up to 1/6 of the solvent value were found. The occurrence of a critical load limit depending on the concentration enables to suppress the efficiency of the additive in the heat exchanger selectively. (HGOE).

13710 (CONF-8511246—, pp 305-311) **Monitoring systems for prevention of losses in district heating networks, 'inspection caterpillar'.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about the development, manifacture and the test of an automobile inspection caterpillar for monitoring and laying of cables in existing district heating channels. Energy losses by damaged or wettened medium pipe isolation should be detected and excluded by a monitoring electronics connected to the cable system. Computer-aided design parameters and prototype models have been developed, new camera systems were investigated and the control cable and control electronics were further developed. (HGOE).

13711 (CONF-8511246—, pp 312-319) **Locating of leakage in district heating pipelines by acoustic correlation analysis.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The factors influencing the locating of leakage at district heating pipelines negatively are discussed. The results of these factors have been investigated systematically by sound propagation measurements for different kinds of pipelaying procedures. The sound propagation in the medium tube wall presents the main reason for the essentially worse acoustic transmission procedure for district heating pipelines compared with drinking water pipelines. Improvements of hydrophones used as measuring instruments are indicated. (HGOE).

13712 (CONF-8511246—, pp 320-329) **Influence of the fiber or particle diameter and the initial density on the heat resistance of fibrous and powdered insulating materials.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

The reduction of the thermal conductivity of fibrous and pulvered isolating materials by evacuation has been investigated with concern to optimal parameter combinations for commercially available isolating materials according to the single-plate-process. Model equations were developed in order to predict the economic-heat technical optimum in designing the heat insulation of district heating pipelines. By the appropriate selection of the samples the entire spectrum of the commercially available fiber thickness and initial density were included. (HGOE).

13713 (CONF-8511246—, pp 330-336) **Optimization of the interdependence between house station and consumer installation in the district heating supply.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

System investigations have been carried out for the maximal utilization of the customer installation and the district heating network at minimal expenditure on both sides. The operating conditions and the measuring data to be registrated very fast and correctly are indicated. Hydraulical phenomena were found to be the reason for the heat loss in defect radiators. (HGOE).

13714 **(CONF-8604218—5) Soil compaction verification.** Todres, H.A. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 13p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900440.

From American Gas Association: distribution/transmission conference; Chicago, IL, USA (28 Apr 1986).

While conducting their maintenance activities, utilities must break and restore pavement. During pavement restoration it is vitally important to ensure adequate compaction of the soil. To ensure that specified standards are met, tests have evolved that are well-suited to highway construction, but poorly suited to utility operations. A novel approach that attempts to address this problem is being tested. In the course of an intensive experimental effort it was found that relatively simple, inexpensive devices could be used to verify compaction in a wide variety of soils. Further confirmatory work has been scheduled.

13715 **(DOE/CE/26519—T1) District heating in Columbus Riverfront Development: A project report for District Heating and Cooling Assessment Program: [Final report].** Davis, R.C. (Columbus Dept. of Development, OH (USA). Div. of Planning). 1986. Contract FG01-85CE26519. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87003904.

In 1984, the City of Columbus, building on the results of previous district heating assessments funded by both the US Department of Housing and Urban Development and the Danish Ministry of Energy, began a survey of the potential for district heating systems in its downtown and riverfront areas. Of particular interest was the potential for refurbishing an old municipal electric plant on the northwest fringe of the downtown as a heat source for a riverfront area targeted for redevelopment. This report describes the background, assumptions, methodology, and conclusions of that assessment. It must be said at the outset that some questions remain unanswered.

13716 **(PB—87-127437/XAB) Multi-user cogeneration systems, natural-gas-fueled group heating and cooling systems: current status, prospects, and research and development needs. Final report.** Marciniak, T.J. (Enerteq Sciences, Inc., Western Springs, IL (USA)). May 1986. 92p. (ESI—86/003). NTIS, PC A05/MF A01.

Natural-gas-fueled group heating and cooling (GHC) systems combined with cogeneration offer an economical alternative to large-scale district heating and cooling systems by (a) lowering capital costs, (b) reducing construction time and (c) increasing thermal efficiency. The GHC concept offers an opportunity to expand the market for natural-gas-fueled packaged cogeneration systems through reductions in installation and operating costs. The report presents a review of the current status, future prospects, and research and development needs of the GHC concept. Also included are technical and economic reviews of district heating and cooling (DHC) applications and packaged cogeneration systems (PCS). Particular emphasis is given to the relationship of DHC and PCS technology to the GHC concept. The GHC/cogeneration concept is suitable for apartment complexes, office and light industrial parks, college campuses, medical facilities, urban redevelopment areas, and the business districts of small cities. Indications are that the installed cost of a new GHC/cogeneration system could be reduced by as much as $600/kW(e) compared to a one-unit PCS installation.

13717 **Electricity shortages in the 1990's?: business strategies for survival.** Scheer, R.M.; Fisher, Z.J. (Battelle Pacific Northwest Labs., Richland, WA). *Strategic Planning and Energy Management;* 6: No. 2, 6-19(1986).

Businesses need to consider a wide range of strategies to make sure that they have enough electricity in the 1990s. These strategies should include working more closely with their local utilities to develop mutually beneficial service agreements that offer off-peak discounts, provisions for planned interruptions of service, or incentives for adopting new technologies. They should also investigate the feasibility of generating on-site electricity, adopting more efficient equipment, or purchasing power from a third-party cogenerator. The local electricity supply outlook and regulatory climate, the nature of the firm's power needs, and the relative economics of the alternative strategies will determine which strategy a business pursues. 3 tables.

13718 **Resource recovery: A solution to two problems.** Walter, D. (Biofuels and Municipal Waste Technology Div., U.S. Dept. of Energy). pp 91-102 of New energy technologies for Illinois and the midwest. Springfield, IL; Illinois Dept. of Energy and Natural Resources (1985). (CONF-8510324—).

From 13. annual Illinois energy conference; Chicago, IL, USA (28 Oct 1985).

With more than 550,000 tons of municipal waste collected and discarded in landfills each day, it is understandable that waste disposal is considered a major problem in the United States and indeed in the world. More significantly this waste is a resource that is of importance and which one can no longer afford to throw away. It is first a potential source of domestic energy that if fully utilized can displace the equivalent of 1.2 million barrels of oil versus U.S. current oil imports of 3.5 million barrels a day. Further, the U.S. Environmental Protection Agency (EPA) has stated that a well designed and operated waste combustion plant is the environmentally preferred solution to the disposal of municipal solid waste (MSW). Finally, a well designed and operated System is the least expensive method for a locality to manage the disposal of MSW in life cycle. These then are the three E's of Energy from Municipal Waste (EMW). The object of this paper is to describe some simple rules that will help achieve the three E's of EMW.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 13731

13719 **(DGRST—80-7-0655) Study of the feasibility of a perfecting device for Diesel engine.** Gratadour, M.; Jourdan, M. (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1982. 25p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750971.

The work described in this report concerns the ongoing study of the feasibility of a device to improve the thermodynamic operation of the Diesel engine by a better self-igniting aptitude of the fuel. The experimental results gathered on the second-generation device constructed during the course of this study and based on results from the first stage have confirmed the ability of the apparatus to carry out such operation (perceptible reduction in the ignition delay). They have also shown up certain defects in reliability which should be mastered before tackling the development phase of this apparatus.

13720 **(DGRST—81-F-0409) Evaluation of the ability and the interest of a mixed operating for a stratified charge engine.** (Delegation Generale a la Recherche Scientifique et Technique (DGRST), 75 - Paris (France)). 1982. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750972.

The study is related to the exploratory implementation on a single cylinder two-stroke engine of an original combustion process with strong excess of air initiated by an ignition control and followed by autoignition. Besides a relative flexibility of the engine vis-a-vis the fuel (octane and cetane index), the process can combine the advantages of fuel-injection Diesel engine with open chamber, the process has displayed characteristics of efficiency and pollutant emission intermediate between the two current types of engine. The results obtained underline in particular the interest of a 4-stroke application of the apparatus.

13721 **(N—87-11144) Hot section viewing system.** Morey, W.W. (United Technologies Corp., East Hartford, CT (USA)). Sep 1984. 141p. (NASA-CR—174773; NAS—1.26:174773; R—84-925830-33). NTIS, PC A07/MF A01.

This report covers the development and testing of a prototype combustor viewing system. The system allows one to see and record images from the inside of an operating gas turbine combus-

tor. The program proceeded through planned phases of conceptual design, preliminary testing to resolve problem areas, prototype design and fabrication, and rig testing. Successful tests were completed with the viewing system in the laboratory, in a high pressure combustor rig, and on a Pratt and Whitney PW20307 jet engine. Both film and video recordings were made during the tests. Digital image analysis techniques were used to enhance images and bring out special effects. The use of pulsed laser illumination was also demonstrated as a means for observing liner surfaces in the presence of luminous flame.

13722 (N—87-11180, pp vp) **Introduction to life modeling of thermal barrier coatings.** Miller, R.A. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Thermal barrier coatings may be applied to air-cooled turbine section airfoils to insulate such components from hot gases in the engine. The coatings, which typically consist of about 0.01 to 0.04 cm of zirconia-yttria ceramic over about 0.01 cm of NiCrAlY or NiCrAlZr alloy bond coat, allow increased gas temperatures or reduced cooling air flows. This, in turn, leads to marked improvements in engine efficiency and performance. However, certain risks are associated with designing for maximum benefits, and eventually a point is reached where coating loss would immediately jeopardize the underlying component. Therefore, designers must be able to accurately predict the life of a given bill-of-material coating in any particular design. The results of an in-house aeronautics, base research and technology program which is designed to provide the first steps towards developing mission-capable life-prediction models are outlined.

13723 (NP—7751161) **Theoretical and experimental analysis of cyclic stresses in gas turbine rotor blades, taking thermal fatigue into account (low cycle fatigue).** Hoelscher, R. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Strahlantriebe und Turboarbeitsmaschinen). Aug 1982. 98p. (In German). NTIS (US Sales Only), PC A05. File Number DE87751161.

The author is concerned with determining the life of highly stressed hot components of gas turbines. The main point of the experimental and theoretical investigations is the analysis of the cyclic stresses of an uncooled turbine rotor blade of an aircraft gas turbine ATAR 101. Apart from simulating cyclic load changes of turbine blades on a model test rig, models of service life predictions are prepared and tested. (HAG).

13724 **The development in direct coal-fired gas turbines for locomotive application.** Bechtel, T.F.; Pitrolo, A.A. Washington, D.C.; Slurry Transport Association (1986). 21p. (CONF-8609165—). Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

From International off-highway and powerplant congress and exposition; Milwaukee, WI, USA (8 Sep 1986).

Maturation of the basic technical knowledge base relating to coal processing, handling, and combustion; materials of construction; and systems design of gas turbines has provided an opportunity to revisit the concept of direct coal firing in a gas turbine. The U.S. Department of Energy (DOE) initiated a scoping program beginning in 1983, and based on promising results has recently entered into a second significant phase of research and development that will lead to proof of concept within 5 years. Four major turbine manufacturers are participating with the DOE along with numerous universities, independent R&D labs, and the national laboratories. Expenditures in the tens of millions of dollars range are expected. Results to date are very encouraging with respect to gas turbine combustion designs, including slagging, nonslagging, and staged (rich/lean) configurations; deposition phenomena and control; particulate removal; alkali release and control; SO/sub x/ control; and NO/sub x/ control.

13725 **Temperature and species concentration measurements in knocking engines prior to autoignition.** Lucht, R.P.; Green, R.M.; Ferguson, C.R. (Sandia National Labs., Livermore, CA 94550). pp 150 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The authors are performing temperature and species concentration measurements in the unburned gases of a knocking internal combustion engine in an effort to understand the chemical kinetics of autoignition. Coherent anti-Stokes Raman scattering (CARS) is used to measure the temperature history of the unburned gases, and species concentrations are measured using a fast sampling valve and gas chromatograph.

13726 **New materials in gas turbine technology.** Johnston, G.R. pp 35-38 of Joint National Symposium on the Influence of Aviation on Engineering and the Future of Aeronautics in Australia, Melbourne, Australia, August 8, 9, 1985, Preprints and Supplementary Papers. Barton, Australia; Institution of Engineers/Brookfield Publishing Co. (1985). (CONF-8508215—).

From Joint national symposium on the influence of aviation on engineering and the future of aeronautics in Australia; Melbourne, Australia (8 Aug 1985).

The present evaluation of materials developed for use in gas turbines places emphasis on novel, next-generation materials applicable to state-of-the-art engines. Attention is given to the results of engine trials conducted by Australia's Defense Science and Technology Organization to assess manufacturer-specified protective coatings on first stage, high pressure turbine blades. Comparisons are made between these data and those for commercially available coatings in the same engines. Recommendations for changes in coatings are made on the basis of these comparison results. 15 references.

3302 External Combustion Engines

13727 **(DOE/NASA/50112—68) Effect of water on hydrogen permeability.** Hulligan, D.; Tomazic, W.A. (Sverdrup Technology, Middleburg Heights, OH (USA); National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jan 1987. Contract AI01-85CE50112. 22p. (NASA-TM—88898). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87005210.

Doping of hydrogen with CO and CO_2 was developed to reduce hydrogen permeation in Stirling engines by forming a low permeability oxide coating on the inner surface of the heater head tubes. Although doping worked well, under certain circumstances the protective oxide could be chemically reduced by the hydrogen in the engine. Some oxygen is required in the hydrogen to prevent reduction. Eventually, all the oxygen in the hydrogen gas - whatever its source - shows up as water. This is the result of hydrogen reducing the CO, CO_2, or the protective inner surface oxides. This water can condense in the engine system under the right conditions. If the concentration of water vapor is reduced to a low enough level, the hydrogen can chemically reduce the oxide coating, resulting in an increase in permeability. This work was done to define the minimum water content required to avoid this reduction in the oxide coating. The results of this testing show that a minimum of approximately 750 ppM water is required to prevent an increase in permeability of CG-27, a high temperature metal alloy selected for Stirling engine heater tubes.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 13564

3305 Flywheel Propulsion

13728 **(PB—87-119079/XAB) Flywheel-powered shuttle car. Open File report.** Christofferson, D. (Engineered Systems and Development Corp., San Jose, CA (USA)). Mar 1986. 175p. NTIS, PC A08/MF A01.

The report documents the program conducted to demonstrate the application of a flywheel-powered propulsion system to underground-mining shuttle cars. Such application can replace the present electrical trailing cable common to most shuttle cars and thereby eliminate those safety hazards, maintenance problems, and haulage-route limitations inherent in the trailing cable. Described are the activities undertaken to specify and design a flywheel of optimum size, shape, and material; to identify the best concepts of input and output systems; and to achieve installation of the power package into a shuttle car. The resultant flywheel-powered shuttle car is an FMC Corp. Model 6L shuttle car, 6-ton capacity, 20-ton gross vehicle weight, powered by a flywheel system with 4.5-kilowatt-hour usable energy. The completed vehicle was delivered to the Bureau of Mines in Bruceton, PA, for testing and evaluation.

3306 Vehicle Design Factors

13729 **(CONF-860821—2) Correct oil drain interval: Natural gas versus gasoline vehicles.** Donakowski, T.D.; O'Sullivan, J.B. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 9p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. File Number TI87900444.

From Gaseous fuels for transportation; Vancouver, Canada (7 Aug 1986).

This presentation describes a program that attempts to quantity increases (if any) in the correct engine oil drain interval for natural gas fueled vehicles compared to gaoline. The test program is comprised of 13 North American utility fleets. Each fleet is providing four vehicles (two primarily using natural gas and two gasoline), whose oil condition is being monitored every two monthes. During the first six months baseline oil drain data will be collected. After that time, oil drain intervals for the natural gas and gasoline vehicles will be extended, where appropriate, to ascertain if there is any statistically significant difference between the two population means. Vehicle use is mostly urban driving. The program commenced on January 2, 1986, and only preliminary results are reported. At the test on-set, the mean oil drain interval for gasoline vehicles was 4400 miles, with a standard deviation of 1400 miles. The test is designed to detect differences of 600 miles or greater in the correct oil drain interval for the two types of vehicles.

13730 **(CONF-861002—4) Introduction and status of the ceramic technology for advanced heat engines project.** Johnson, D.R.; Schulz, R.B. (Oak Ridge National Lab., TN (USA); USDOE, Washington, DC). Oct 1986. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. File Number DE87004403.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (27 Oct 1986).

The Ceramic Technology for Advanced Heat Engines Project of the Advanced Materials Development Program was initiated in 1983 to meet the ceramic materials technology requirements of the companion DOE engine programs, the Advanced Gas Turbine Program, and the Heavy Duty Transport (low heat rejection heavy duty diesel) Program. Our goal is the technology base that will allow private industry to supply reliable and cost effective ceramics for applications in these advanced engines. Accordingly, our program includes the following objectives: improved and new synthesis and fabrication technology to improve the reliability of monolithic ceramics, toughened ceramic composites, and ceramic coatings; improved and new joining technology required for reliable ceramic attachments; an understanding of the physical and chemical mechanisms that control the friction and wear of ceramic materials and coatings under heat engine operating conditions; and identification and understanding of the mechanisms that control the long-term mechanical reliability of structural ceramics in advanced engine environments.

3307 Emission Control

13731 **(PB—87-102315/XAB) Soot initiation in diesel environments. Final report.** Rawlins, W.T.; Cowles, L.M.; Krech, R.H.; Boni, A.A. (Physical Sciences, Inc., Andover, MA (USA)). Aug 1984. 32p. (PSI-TR—456). NTIS, PC A03/MF A01.

The goal of this research was to study soot initiation in the pyrolysis and oxidation of toluene at 30 atm and 1300-2500 K. Soot formation at these conditions were rapid and extensive, with evidence of significant particle growth during the approximately 2 ms test time. The extreme rapidity of soot initiation suggests that unimolecular pyrolysis reactions are the controlling processes for conversion of fuel carbon to soot. The substantial growth of the particle is manifested by an increase in infrared radiation that raises concerns about the implications for greater radiative loading and more-difficult particle burnout. Oxidation causes a reduction in sooting; it is unclear whether this results from oxidation of gas-phase hydrocarbons or burnout of the soot particles themselves. The apparent absence of an oxidative effect lowering the temperature of the sooting maximum, points to potentially larger soot-forming regions in a diffusion flam.

13732 **(PB—87-103412/XAB) Environmental Protection Agency (EPA) audits of state and local inspection/maintenance programs. Technical report.** Lorang, P.A.; Armstrong, J.A.; Cabaniss, J.M. (Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). 18 Jun 1985. 18p. (EPA/AA/TSS/IM—85/09). NTIS, PC A02/MF A01.

From 78. annual meeting and Exhibition of the Air Pollution Control Association; Detroit, MI, USA (18 Jun 1985).

Many State and local agencies have implemented vehicle emissions I/M programs in the last few years. EPA began to audit these programs in federal fiscal year 1984. Results of the I/M audits indicate that (1) enforcement is a problem in some programs with sticker-based enforcement; (2) low reported failure rates are a problem in many decentralized programs, especially government programs; (3) high waiver rates are a problem in some programs, both centralized, and decentralized; (4) analyzer quality-assurance ranges from excellent in centralized, contractor programs to marginal in decentralized programs with manual analyzers and in some centralized government run programs; (5) data analyses are not being effectively used in most programs to monitor and improve program performance and the performance of individual inspection stations; (6) the quality of I/M repairs is a problem, to some extent, in every program audited. EPA believes that the resolution of these problems generally rests with each State/local I/M program developing an overall I/M quality assurance program to ensure that problems are identified and resolved in a timely manner.

13733 **Acid Deposition Control Act of 1986 (Part 2). Hearings before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, Ninety-Ninth Congress, Second Session, H.R. 4567, May 1, 1986.** Washington, DC; Government Printing Office (1986). 509p.

A hearing on H.R. 4567, which amends the Clean Air Act, focused on the impact that vehicle emission standards has had on the automobile industry's effort to develop control technology. The proposed bill would require an 84% rather than a 43% decline in nitrogen oxide emissions in one year, which would put a substantial burden on the industry. The 18 witnesses included representatives of the automotive industry, manufacturers, utilities, environmentalists, and research institutes. Research findings on lake acidification and plant damage supported the proposed standards, while arguments of economic impacts on both industry and consumers were made in opposition. Additional statements and material submitted for the record follows the testimony.

3308 Alternative Fuels

13734 (DOE/MC/21175—2257) Coal-fueled diesel: Cycle simulation: Final report. Caton, J.A.; Bell, S.R. (Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). 31 Dec 1986. Contract AC21-84MC21175. 223p. NTIS, PC A10/MF A01. File Number DE87003352.

An engine cycle simulation for a coal-fueled internal combustion, reciprocating engine was developed. The primary objective of this work was to develop the simulation for evaluating the viability of coal fuels for engines. The cycle simulation was used to investigate details of the combustion process to identify controlling phenomenon and to establish directions for future evaluations. Models for coal particle combustion and devolatilization, liquid droplet vaporization, fuel vapor combustion, cylinder heat transfer, piston work, and mass flow rates were combined with a thermodynamic analysis of the engine to yield instantaneous cylinder conditions and overall indicated engine performance. For selected engine and operating conditions, sensitivity of engine performance on fuel characteristics such as coal reactivity, devolatilization, liquid carriers, atomization, and pilot fuels for ignition were investigated. Several commercially manufactured engines were also simulated with the model. The major conclusions of this work include: (1) devolatilization can have a significant effect on the ignition and combustion processes, (2) liquid carriers can have a significant effect on the ignition and combustion processes, (3) the cylinder gas temperature and pressure at fuel injection are important engine operating parameters for coal fuels, (4) the characteristics of the coal fuel (such as particle size and reactivity) can have a significant impact on the ignition and combustion processes, and (5) the combustion process of coal slurry fuels is largely diffusion (air mixing) controlled. 98 refs., 64 figs., 20 tabs.

35 ARMS CONTROL

13735 (AD-A—173675/0/XAB) Report of the Defense Science Board Task Force on small intercontinental ballistic missile modernization. Final report. (Defense Science Board, Washington, DC (USA)). Mar 1986. 32p. NTIS, PC A03/MF A01.

The Task Force considered a range of ICBM and basing alternatives, with emphasis on the question of survivability and stability. The principal deployments analyzed were: (1) 500 Small ICBMs (SICBMs) deployed in Hard Mobile Launchers (HMLs) on four existing U.S. Government complexes in the Southwest; (2) 50 MX ICBMs deployed in a variable number of superhard silos (patterned array); and d(3) 50 MX ICBMs deployed in carry hard configuration, i.e., in hardened cannisters deployed among a large number of low-cost vertical shelters. The Task Force concluded that there is at least one SICBM basing mode -- and possibly one or more MX basing modes -- which, although costly, have a high degree of survivability and accordingly are suitable candidates for deployment by the U.S.

36 MATERIALS

REFER ALSO TO CITATION(S) 13054

13736 (DOE/ER/13158—T2) The effect of catalyst preparation on catalytic activity: Final report, December 1, 1983-November 31, 1986. Schwarz, J.A. (Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science). Dec 1986. Contract AC02-84ER13158. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004380.

The performance of catalysts has been shown to be strongly dependent on their methods of preparation. The objective of our research has been to examine the effect of preparation procedures including metal concentration and pH of the impregnation solution on the catalytic properties of supported-metal catalyst systems. Design parameters have been identified for Ni/Al_2O_3 catalysts prepared by incipient wetness and wet impregnation from nickel nitrate solution in contact with a γ-Al_2O_3 support. The metal dispersion, activity for C_1, C_2, and C_3 formation under synthesis conditions, and the carbon deposited during reaction have been shown to be predictable based solely on the properties of the electrolytes from which these catalysts were formed.

13737 (DOE/ER/13163—13) Mechanical interactions of rough surfaces: Quarterly progress report for period September 30, 1986 to December 31, 1986. McCool, J.I. (SKF Industries, Inc., King of Prussia, PA (USA). SFK Tribonetics). Jan 1987. Contract AC02-84ER13163. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004237.

A presentation was prepared and delivered at the ASME/ASLE Joint Tribology Conference in October. The presentation emphasized the applicability of a proposed approach for interpreting roughness data with respect to the stress conditions prevailing at microcontacts. Highlights are given of a paper drafted during this reporting period, in which an elastic-plastic traction model is evaluated with respect to two sets of data which reflect the effects of lateral sliding and spin on traction curve slope and the effect of spin velocity on spinning torque.

13738 Degradation mechanisms in thermal-barrier coatings. Shinde, S.L.; Olson, D.A.; De Jonghe, L.C.; Miller, R.A. *Ceramic Engineering and Science Proceedings;* 7: 1032-1038(Aug 1986). (CONF-860152—).

From 10. annual conference on composites and advanced ceramic materials; Cocoa Beach, FL, USA (19 Jan 1986).

The degradation mechanism in a thermal barrier-coating system subjected to prolonged heating in air as well as to thermal cycling was studied. Bond-coat oxidation was found to be the most important reason for degradation. The oxidation produced NiO as well as Al_2O_3 in one set of samples, but the variation in initial coating structure made it difficult to resolve systematic differences between isothermally heated and thermally cycled samples. However, the contribution to degradation from changes in substrate composition seemed less in the cycled sample. 6 references.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 13056, 13263, 13264, 13323, 13328, 13385, 13396, 13438, 13455, 13464, 13465, 13504, 13519, 13533, 13797, 13815, 13875, 14068, 14169, 14607

13739 (AD-A—172955/7/XAB) Direct synthesis and optimization of rare-earth transition-metal permanent-magnet systems. Final technical report, 1 August 1983-31 July 1986. Cadieu, F.J. (Queens Coll., Flushing, NY (USA). Dept. of Physics). 15 Sep 1986. 43p. NTIS, PC A03/MF A01.

Special sputtering methods were used to synthesize rare earth-transition metal films such as $SmCo_5$, $Nd_2Fe_{14}B$, and several new compounds in the Sm-Ti-Fe system. Films were synthesized with different crystal textures by varying the sputtering conditions. The magnetic properties observed were found to be strongly dependent on the film texture. For example, $SmCo_5$ films with a (200) texture exhibit intrinsic coercive forces, of 8 kOe, while (110) textured films show values of about 18 kOe. For the $Nd_2Fe_1]3$$B compound, films were made that exhibit an easy axis of magnetization either in the film plane or out of the film plane depending upon the crystal texturing of the films. In the film plane-static energy products up to 21 MG-Oe were observed in as-sputtered films without any subsequent heat treatments in certain rare earth-transition metal systems. For films containing only Sm, Ti, and Fe room temperature coercive-force values up to 24 kOe were observed. Films were also made such that the magnetic properties are highly anisotropic in the plane of the film for certain amorphous systems. The incorporation of the coercive-force magnetic films that have been sputter synthesized into several types of micron-scale-device geometries was considered.

13740 (AD-A—173734/5/XAB) Deformation of rapidly solidified Ti-2Er. Technical report. Kampe, S.L.; Koss, D.A. (Pennsylvania State Univ., University Park (USA). Dept. of Materials Science and Engineering). Sep 1986. 8p. (TR—3). NTIS, PC A02/MF A01.

The deformation of rapidly solidified Ti-2Er was studied over a range of temperatures from ambient to 775C. When compared to the behavior of Ti tested under parallel conditions, the re-

sults indicate that although dispersion strengthening occurs, its magnitude is dependent on temperature, strain rate, and grain size. Minimal strengthening is observed in fine grained materials at high temperatures and low stress and strain rates. This behavior, combined with microstuctural observations using transmission electron microscopy, indicates a susceptibility to grain-boundary sliding at elevated temperatures.

13741 **(AD-A—174291/5/XAB) Thermal barrier coatings for shipboard protection. Final report, 1 March 1982-31 December 1984.** Herman, H. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering). 7 Nov 1986. 16p. NTIS, PC A02/MF A01.

It was found that thermal-sprayed cermet coatings on aluminum shipplate retard degradation of the base metal. The thermal behavior of the Al_2O_3 and ZrO_2 cermets was different and showed the best properties in the 20 and 50% (approximately) ceramic compositions, respectively. There was no corrosion problem when the atomized Ni-Al was used. The cermet coatings adhered to the substrates under high plastic strains in excess of normal service conditions (assuming elastic criteria). A further investigation showed that acoustic-emission techniques could readily detect coating detachment within the critical plastic-deformation range of the aluminum substrate.

13742 **(AD-A—174553/8/XAB) Rapid-solidification processing and powder metallurgy of al alloys. Final technical report, 15 April 1982-15 April 1985.** Fraser, H.L. (Illinois Univ., Urbana (USA). Dept. of Material Science). 29 Oct 1986. 76p. NTIS, PC A05/MF A01.

Regarding work on the development of microstructure during rapid solidification, three areas were addressed. The first of these involved a determination of the mechanism of formation of the so-called zones A and B in hypereutectic Al-transition metal alloys. The second area of work involving the development of microstructure concerns submerged phase transformations. In a study of Al-Be hypereutectic alloys, it was determined that solidification proceeded by a set of phase transformations that may be described by a monotectic reaction. The third area of study concerning microstructural development involves quasi-crystalline Al alloys. In fact, work done in this program has concentrated on the potentially beneficial aspects of quasi-crystalline phases in the microstructure of Al alloys. Work on the consolidation of particulate was concentrated on the use of conventional techniques (.e. extrusion) and novel processes (i.e. dynamic compaction). An estimate of the mechanical properties of rapidly solidified Al alloys was obtained. As explained above, the effect of extrusion is to cause decomposition of the rapidly solidified microstructure. A comparison was made, using the alloy Al-8Fe-2Mo, between the tensile properties of the decomposed microstructure (.e. extruded) and subscale test specimens produced by laser surface melting, consisting entirely of zone A.

13743 **(ANU-P—936) Active gas discharge cleaning for superconducting lead-plated resonators.** Malev, M.D.; Weisser, D.C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Jun 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780486.

Lead-plating for superconducting RF resonators historically has been directed toward reducing grain size and eliminating spikes on the surface. Investigations were made of degassing lead-plated surfaces under RF resonant electron discharge of multipacting. The mass-spectra of the residual atmosphere showed that decomposition of hydrocarbons on the surface took place. Discoloration of the lead surface, due to the formation of a carbon layer, was easily observed. A method of cleaning surfaces by ion bombardment employing chemically active gases, was proposed and tested. An RF discharge, initiated by multipacting at pressure 10^{-2} - 10^{-1} torr was used. The first step-discharge treatment in a CO_2 atmosphere, assures oxidation of carbon and hydrocarbons into gaseous compounds which are removed by pumping. During the second step, discharge treatment in a hydrogen atmosphere, lead oxides are reduced to metal.

13744 **(BMI—1000) Compilation of US and UK uranium and thorium constitutional diagrams.** Saller, H.A.; Rough, F.A. (Battelle Memorial Inst., Columbus, OH (USA)). 1 Jun 1955. Contract W-7405-ENG-92. 137p. NTIS, PC A07/MF A01. File Number DE87004904.

A data compilation are presented for: uranium binary systems for which there are and are not phase diagrams, uranium ternary systems, thorium binary systems for which there are and are not phase diagrams, and one thorium ternary system (Th-Be-Si). (DLC)

13745 **(BNL—39003) Polarized neutron diffraction studies of Gd-Y synthetic superlattices.** Majkrzak, C.F.; Cable, J.W.; Kwo, J; Hong, M.; McWhan, D.B.; Yafet, Y.; Waszczak, J.V.; Grimm, H.; Vettier, C. (Brookhaven National Lab., Upton, NY (USA); Oak Ridge National Lab., TN (USA); Bell Labs., Murray Hill, NJ (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1986. Contract AC02-76CH00016;AC05-84OR21400. 11p. (CONF-861111—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004067.

From Conference on magnetism and magnetic materials; Baltimore, MD, USA (17 Nov 1986).

The microscopic magnetic structures of coherent, single crystal, epitaxially grown superlattices consisting of successive bilayers of N/sub Gd/ basal planes of hexagonal-close-packed Gd followed by N/sub Y/ such atomic planes of non-magnetic Y have been studied by polarized neutron diffraction. It has been found that for N/sub Gd/ = 10, either a simple parallel alignment of the ferromagnetic Gd layers or an antiphase domain structure occurs depending on the number of intervening Y planes in an oscillatory manner. These data are consistent with an RKKY coupling mechanism between Gd layers. In addition to the investigation of the interlayer interactions, measurements of the magnetization profile across the thickness of a Gd layer have been performed.

13746 **(BNL—39073) EXAFS studies of grain boundary diffusion and segregation.** Heald, S.M.; Chen, H.; Tranquada, J.M. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 4p. (CONF-861207—40). NTIS, PC A02. File Number DE87003435.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The dominant pathway for thin film interdiffusion and interface reactions is often via grain boundaries. We have made EXAFS measurements of grain boundary constituents for two systems: interdiffusion in Ag-Au bilayers and solid state reaction of Nb with a copper-tin bronze to form Nb_3Sn. The Ag-Au results indicate that Au in saturated Ag grain boundaries has an environment similar to a dilute Au in Ag solution with reduced coordination. For the Nb-bronze reaction, the results for the Cu environment indicate distinct changes in the grain boundary environment when small amounts of Ti, Hf, Zr, and Ta are added to the starting Nb. Both results demonstrate the ability of EXAFS to probe grain boundary environments, and to provide important structural information in understanding solid state diffusion and interdiffusion in thin film systems.

13747 **(BNL—39074) Structure of copper-hafnium multilayers.** Clemens, B.M.; Stec, J.P.; Heald, S.M.; Tranquada, J.M. (Brookhaven National Lab., Upton, NY (USA); General Motors Research Labs., Warren, MI (USA). Physics Dept.). 1986. Contract AC02-76CH00016;AS05-80ER10742. 8p. (CONF-861207—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004180.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The structure of copper-hafnium multilayers has been studied as a function of composition modulation wavelength by x-ray diffraction and EXAFS. Sputter deposited samples were produced with composition modulation wavelengths of 1/2, 5, 7, 10, 14, and 20 close packed planes of each constituent per layer. The structure evolved anisotropically from amorphous to crystalline with increasing composition modulation wavelength, with crystalline order first appearing in the growth direction in the 7 monolayer sample.

Structural coherence in the growth direction was not observed to extend beyond one elemental layer in any sample, and evidence for a disordered interfacial layer was observed by EXAFS for all samples. Small angle x-ray diffraction showed strong composition modulation for all but the 1/2 monolayer sample. The amorphous interface is the result of reaction during deposition similar to the solid state reaction observed in other systems such as nickel-zirconium.

13748 **(CONF-860540—8) Segregation of sulfur to grain boundaries in chromia and alumina scales.** Kim, Y.K.; Przybylski, K.; Yurek, G.J. (Massachusetts Inst. of Tech., Cambridge (USA). Corrosion Lab.). 1986. Contract FG02-85ER45179. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003771.

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

The oxidation of an Fe-25wt %Cr and an Fe-25wt %Cr-10wt %Al alloy at 900°C in H_2-H_2O gas mixtures containing small amounts of H_2S has been studied. The oxidation products were Cr_2O_3 and Al_2O_3 for the Fe-Cr and Fe-Cr-Al alloys, respectively. In the presence of H_2S, sulfur segregated to the grain boundaries in the oxide scales, which increased the rate of growth of Al_2O_3 and decreased the rate of growth of Cr_2O_3. Possible reasons for these effects are discussed.

13749 **(CONF-860540—9) Oxidation behavior of chromium and a chromium-yttrium binary alloy.** Cotell, C.M.; Przybylski, K.; Yurek, G.J. (Massachusetts Inst. of Tech., Cambridge (USA). Corrosion Lab.). 1986. Contract FG02-85ER45179. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003772.

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

The effect of an addition of 0.04 wt % Y on the oxidation behavior of pure Cr at 900 and 1025°C has been investigated. The microstructures and chemical compositions of the Cr_2O_3 scales formed were studied both parallel and transverse to the oxide/metal interface by SEM, TEM, and STEM. Oxidation kinetics were measured by TGA and the direction of scale growth determined using inert markers. At 900°C, the rate of scale growth, the direction of scale growth and the scale microstructure were unchanged by the addition of 0.04 wt % Y to Cr At 1025°C, the direction of scale growth and scale microstructure were unchanged by the addition of 0.04 wt % Y, but the rate of oxidation was reduced by a factor of six. A model for the development of the microstructures of chromia scales formed on Cr and Cr-0.04 wt % Y is presented, and the effect of yttrium on the rate of growth of chromia at 900 and 1025°C is discussed.

13750 **(CONF-861207—26) An atom probe study of boron segregation to line and planar defects in Ni_3Al.** Horton, J.A.; Miller, M.K. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004070.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Atom probe analyses of rapidly solidified, boron-doped Ni-24 at. % Al subjected to various heat treatments have shown boron segregation to a wide range of linear and planar defects. These include dislocations, superlattice intrinsic stacking faults, antiphase boundaries, twin boundaries, low-angle boundaries (dislocation cell walls) and high-angle grain boundaries. Boron coverage of these features was found to vary along a particular linear or planar defect and from boundary to boundary.

13751 **(CONF-861207—27) Site occupation determinations in Ni_3Al by atom probe.** Miller, M.K.; Horton, J.A. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004064.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The site occupation of three substitutional elements, hafnium, iron and cobalt, in substoichiometric Ni_3Al was determined from atom probe field-ion microscopy. The hafnium was found to have a strong preference for the aluminum sites, the cobalt had a strong preference for the nickel sites, and the iron had a weak preference for the aluminum sites. The atom probe results were in agreement with zone axis electron channeling microanalysis of the same alloys and predictions from the position of the solubility lobes in the ternary phase diagrams.

13752 **(CONF-861207—28) Ion-induced growth of whiskers on Sn films.** Poker, D.B.; Schubert, J.; Stritzker, B. (Oak Ridge National Lab., TN (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Dec 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004275.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Whiskers have been observed to form on thin films (100 nm) of Sn following implantation of 20-keV H or He at temperatures below 150 K. The morphology of the whiskers following growth was examined using scanning electron microscopy (SEM) to illuminate the possible growth modes. In an effort to obtain support for either of several models of the growth process, the region near the base of the whiskers was examined for evidence of depletion or extrusion. No evidence of depletion was observed. The whiskers could be classified into two types: those that were supported on pedestals, a short transition region at the base of the whiskers; and those without pedestals, which rose abruptly from the film with no transition. A novel structure has been observed on Sn films that were coated with 500 A of Au/Pd to enhance the SEM image. The structure consists of a thin, planar surface several microns in length, oriented perpendicular to the substrate. The structures did not appear immediately after coating, but were present after storage in air for one month.

13753 **(CONF-861207—29) Creep cavitation in a nickel aluminide.** Schneibel, J.H.; Martinez, L. (Oak Ridge National Lab., TN (USA); Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Fisica). Dec 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004276.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A nickel aluminide with the composition Ni-23.5, Al-0.5 Hf-0.2 B (at. %) has been creep-tested in tension at constant load (initial stress 250 MPa, temperature 1033K). The creep rate reaches a minimum at a strain of approximately 0.3%. Its increase at lalrlger strains is partly caused by grain boundary cavitation. Cavity size distributions corresponding to different creep times and strains were determined metallographically and evaluated in order to obtain the cavity growth rate as a function of cavity size. Contrary to a newly developed model for crack-like diffusive growth the cavity tip velocity increases with cavity size. This discrepancy is attributed to cavity coalescence. Sintering at elevated temperatures (1473K) reduces the diameter and increases the thickness of the disc-shaped cavities. Sintering of such cavities might be exploited to measure surface diffusivities.

13754 **(CONF-861207—39) The effect of cooling rate during rapid solidification on the structure and texture of NiTi.** Pedraza, A.J.; Godbole, M.J.; Kenik, E.A.; Pedraza, D.F.; Lowndes, D.H. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Materials Science and Engineering). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004209.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A study has been conducted on the effects of increasing cooling rate during rapid solidification of NiTi upon the phases that are produced. The hammer and anvil rapid solidification technique and laser melting with a nanosecond excimer laser were used, which allow the cooling rate to be varied by three to four orders of magnitude. Although 1/3 [110] superlattice reflections are seen in the selected area diffraction (SAD) patterns of the splat quenched (SQ) specimens, x-ray diffraction analyses show the presence of only B2 phase and martensite. On the other hand, laser treatment (LT) of the specimens produces a layer that has a $L1_0$ structure with a slight monoclinic distortion. This phase can be envisaged as

a small distortion of a B2 unit cell with a volume per atom ~3.3% lower than the equilibrium B2 phase. Also martensite is present in the layer. SQ alloys exhibited a marked [200] texture due to columnar growth opposite to the direction of heat extraction, while LT produces epitaxial regrowth of the melted layer. No substantial disordering is obtained in NiTi rapidly solidified alloys.

13755 **(CONF-861207—42) Structural studies of nickel films and their interface with sapphire substrates.** Sparks, C.J.; Hasaka, M.; Easton, D.S.; Baik, S.; Habenschuss, T.; Ice, G.E. (Oak Ridge National Lab., TN (USA); Nagasaki Univ. (Japan). Dept. of Materials Science and Engineering; Oak Ridge Associated Universities, Inc., TN (USA)). 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. File Number DE87004397.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The perfection of epitaxial nickel films grown on the (00.l) or basal plane of heated sapphire (Al_2O_3) single crystals were studied with x-ray diffraction techniques. Nickel films approximately 700 A thick formed by vapor deposition increased in perfection as the temperature of the sapphire approached 1400°C. Although the nickel atom distances are 10.3% smaller than those of the closed-packed direction in sapphire, the strain was accommodated at the interface rather than being distributed through the thickness of the nickel film. Diffuse rods of x-ray scattering which are associated with diffraction from the interface gave information about the nature of the roughness at the interface.

13756 **(CONF-8511259—1) Study of Mo, Au, and Ni implanted molybdenum laser mirrors by spectroscopic ellipsometry.** Snyder, P.G.; Bu-Abbud, G.H.; Oh, J.; Woollam, J.A.; Poker, D.; Aspnes, D.E.; Ingram, D.; Pronko, P. (Nebraska Univ., Lincoln (USA); Oak Ridge National Lab., TN (USA); Bell Labs., Murray Hill, NJ (USA); Universal Energy Systems, Inc., Dayton, OH (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02. File Number DE87004393.

From Boulder damage symposium; Boulder, CO, USA (17 Nov 1985).

The implantation of 150-keV molybdenum ions into polished molybdenum laser mirrors is found to increase the complex dielectric constant in the visible spectrum. Analysis using the Bruggeman effective medium approximation demonstrates that the increase is due to surface smoothing, and that the surface is made nearly atomically smooth by a fluence of 5 x 10^{15}/cm^2. Implantation of Au at 1MeV caused considerable microscopic roughening, as well as a change in the bulk optical properties. 3-MeV Ni ion implantation caused only a slight surface roughening. A thin dielectric film (probably a hydrocarbon) is found to condense in a laboratory atmosphere, reducing the reflectivity, and is removable by rinsing with methanol and distilled water.

13757 **(CONF-8607104—1) Microscopy techniques in corrosion research.** Lee, R.H.; Baxter, D.J. (Argonne National Lab., IL (USA)). Jul 1986. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001544.

From INTER/MICRO '86: international conference on microscopy; Chicago, IL, USA (21 Jul 1986).

This paper describes techniques for the preparation of metallographic specimens from corrosion test samples. These techniques minimize damage to corrosion scales while permitting rapid processing of multiple specimens.

13758 **(DOE/ER/45148—2) The structure and mechanical properties of stoichiometric Ni_3Al and of Ni_3Al alloyed with boron.** Schulson, E.M. (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). Dec 1986. Contract FG02-84ER45148. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004315.

Purpose was to understand the mechanisms underlying the plastic flow and fracture of stoichiometric Ni_3Al with (750 ppM = 0.35 at.%) and without boron. Experiments were carried out on the tensile strength of both alloys as a function of grain size (2 μm to 1100 μm) and temperature (77K to 1023K). Deformation structures of both alloys were examined using transmission electron microscopy, both through in-situ straining of thin foils and through post-deformation analysis of foils prepared from bulk specimens.

13759 **(DOE/ER/45206—3) [Basic studies of submicron layers of niobium-aluminum]: Progress report.** Foner, S. (Massachusetts Inst. of Tech., Cambridge (USA). Francis Bitter National Magnet Lab.). 29 Dec 1986. Contract AC02-78ET51013;FG02-85ER45206. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004131.

Purpose of the research program here is a basic study of model layered structures of Nb and Al in order to develop an understanding of the basic properties of low temperature reacted Nb-Al. The research employs bilayers and multilayers of Nb and Al to study the effects of layer structures, oxygen, third element additives, proximity, and mechanisms for high critical currents in thin layers.

13760 **(DOE/MC/21186—2260) Corrosion resistant materials in MCFC [molten carbonate fuel cell] environment: Final report, October 1984-September 1986.** Pigeaud, A.; Yuh, C.Y.; Singh, P. (Energy Research Corp., Danbury, CT (USA)). 1986. Contract AC21-84MC21186. 145p. NTIS MF A01; 2; GPO Dep. File Number DE87004199.

This report describes a 24-month effort in the development of a corrosion resistant hardware material for molten carbonate fuel cell (MFC) application. The objective of this program was to identify an inexpensive alloy for MCFC current collector/bipolar plate application. For this work, 310S was selected as the base alloy composition and La, Ce and Si were added to improve corrosion resistance. Eight candidate alloys, including 310S and 316L, were screened in MCFC anode and cathode atmospheres. The techniques used include isothermal corrosion, acoustic emission, thermal cycling corrosion, thermogravimetric analyses, electrical surface resistance, and dual atmosphere corrosion testing. Oxide scales formed were analyzed by standard metallographic techniques. The results indicate that COLT-25+ and Crutemp-25 alloys (both containing 25Cr-25Ni and balance Fe) have the best corrosion resistance in the MCFC environment. Rare earth additives, La and Ce, do not appear to improve isothermal or thermal cycling resistance a great deal. Silicon addition appears to improve thermal cycling but not isothermal corrosion resistance. High Mn content (~18%) appears detrimental based on this limited investigation. Currently used 316L has the least corrosion resistance of all the alloys tested. Pressurized tests have shown that high pressure (10 atm) reduces corrosion rate in the anode atmosphere whereas it only slightly affects corrosion rate in the cathode atmosphere. 37 refs., 47 figs., 12 tabs.

13761 **(HEDL—7624) Swelling of solute-modified Fe-Cr-Mn alloys in FFTF [Fast Flux Test Facility]-MOTA.** Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76FF02170. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87005454.

Density change data continue to be accumulated on solute-modified and commercial Fe-Cr-Mn alloys irradiated at 520°C and 50 dpa. The tendency toward saturation of density change observed in the simple ternary alloys in the annealed condition is accentuated by cold-working and solute addition. Irradiation at 420°C appears to further accelerate the tendency toward saturation.

13762 **(HEDL-SA—3398-FP) Evaluation of ferritic alloy Fe-2 1/4Cr-1Mo after neutron irradiation: Microstructural development.** Gelles, D.S. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1986. Contract AC06-76FF02170. 61p. (CONF-860605—37). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004350.

From 13. international symposium on the effects of radiation on materials; Seattle, WA, USA (23 Jun 1986).

As part of a program to provide a data base on the bainitic alloy Fe-2-1/4-1Mo for fusion energy applications, microstructural examinations are reported for nine specimen conditions for 2-1/4Cr-1Mo steel which had been irradiated by fast neutrons over the temperature range 390 to 510°C. Void swelling is found following irradiation at 400°C to 480°C. Concurrently dislocation structure and

precipitation developed. Peak void swelling, void density, dislocation density and precipitate number density formed at the lowest temperature, approximately 400°C, whereas mean void size, and mean precipitate size increased with increasing irradiation temperature. The examination results are used to provide interpretation of in-reactor creep, density change and post irradiation tensile behavior.

13763 **(HEDL-SA—3415-FP) Microstructural examination of several commercial alloys neutron irradiated to 100 dpa.** Gelles, D.S. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76FF02170. 14p. (CONF-860421—68). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004342.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Fusion reactor design to an integrated first wall loading of 40 MW/y/m² or 500 dpa, produces extreme demands on structural materials. It is very difficult to conceive of material behavior at such high damage levels. In an effort to assess the consequences of such damage, a series of commercial alloy specimens have been examined following irradiation with fast neutrons to doses on the order of 100 dpa (20% of goal fluence) at 400°C or 540°C. The alloys were iron or nickel based and included ferritic (martensitic) and austenitic alloys. Examinations incorporated transmission electron microscopy and analytical electron microscopy of irradiated specimens. Microstructural examinations confirm that ferritic alloys are very low swelling, but precipitate development can be very complex. Austenitic alloys can be very high swelling but no clearly defined microstructural differences were found between two alloys of similar composition but very different swelling response or between alloys of very different composition but with similar levels of swelling. Differences are ascribed to differences in the onset of swelling.

13764 (INIS-SU—392, pp 534) **Study of hydrogen embrittlement in steels using nuclear-physical technique.** Babadzhanov, R.D.; Belyanin, O.P.; Pogrebnyak, A.D. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13765 (INIS-SU—392, pp 551) **Possibilities of NMR technique application for studying tin-containing system phase diagrams.** Babikova, Yu.F.; Evstyukhina, I.A.; Sokolova, O.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13766 (INIS-SU—392, pp 549) **Effect of charged particle irradiation on Fe atom redistribution in Cu-Fe alloys.** Ali-Zade, I.I.; Binnatov, K.G.; Gruzin, P.L.; Kurnaev, S.A.; Petrikin, Yu.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13767 (INIS-SU—392, pp 559) **Study of argon distribution in molybdenum using /sup 40/Ar(p,γ)/sup 41/K reaction.** Antuf'ev, Yu.P.; Dikij, N.P.; Zabolotnyj, V.D.; Matyash, P.P.; Litvinenko, A.S.; Storizhko, V.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13768 **(LA-UR—86-4346) Stage IV work hardening in cubic metals.** Rollett, A.D.; Kocks, U.F.; Doherty, R.D. (Los Alamos National Lab., NM (USA); Drexel Univ., Philadelphia, PA (USA)). 1986. Contract W-7405-ENG-36. 16p. (CONF-861076—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003756.

From Fall meeting of the Metallurgical Society of AIME; Orlando, FL, USA (5 Oct 1986).

The work hardening of fcc metals at large strains is discussed with reference to the linear stress-strain behavior often observed at large strains and known as Stage IV. The experimental evidence shows that Stage IV is a work hardening phenomenon that is found quite generally, even in pure fcc metals subjected to homogeneous deformation. A simple model for Stage IV in pure metals is presented, based on the accumulation of dislocation debris. Experiments are described for large strain torsion tests on four aluminum alloys. The level and extent of Stage IV scaled with the saturation stress that would represent the end of Stage III in the absence of a Stage IV. Reversing the torsion after large prestrains produced transient reductions in the work hardening. The strain rate sensitivity was also measured before and during the transient and found not to vary significantly. The microstructure observed at large strains in an Mg alloy suggest that Stage IV can occur in the absence of microband formation. Previous proposals for the cause of Stage IV are reviewed and found to be not supported by recent experimental data.

13769 **(LBL—21663) Design of dual phase steels for bars and rods.** Thomas, G. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering; Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 30p. (CONF-8607102—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003535.

From International symposium on microalloying and new processing approaches; Golden, CO, USA (8 Jul 1986).

Low carbon dual phase ferrite-lath martensite composite steels for rods and bars have been designed to meet cold forming requirements. The rounds can be prepared by conventional processing followed by heat treatment or directly on-line in rod or bar mills. The products are fine grained rods or bars which show exceptional promise for applications such as cold drawing to wires without patenting heat treatments, cold heading for fasteners and as reinforcing bars for the construction industry. These steels also have superior ductility, fatigue, low temperature toughness and corrosion resistance compared to conventional mild or high carbon steels. Specific properties can be tailor made by appropriate design of composition and processing to control the composite microstructure and morphology.

13770 **(LBL—22647) The effect of surface-applied reactive elements on the high temperature oxidation of chromium-containing alloys.** Hou, P.Y. (California Univ., Berkeley (USA)). Nov 1986. Contract AC03-76SF00098. 179p. NTIS, PC A09. File Number DE87004601.

Addition of reactive metals, such as Y, Ce, La, etc., or fine dispersions of their oxides, to alloys containing Cr contributes to the oxide scales formed at high temperatures. This study is concerned with the influence of the reactive metals and/or their oxides when they are present only on the alloy surfaces prior to the oxidation at 1000°C and 1100°C in 1 atm. O_2. Three binary alloys were used: Co-15wt %Cr, a non-Cr_2O_3 former which will develop the Cr_2O_3 scale with reactive metal oxide additions; Co-25wt %Cr, a borderline Cr_2O_3 former and Ni-25wt %Cr, a good Cr_2O_3 former. The oxides of Ca, Ce, La, Y, Hf and Zr were applied as a thin surface coating through the application and decomposition of their aqueous nitrate salts. Y and La were also implanted. None of the surface-applied oxides promoted a continuous Cr_2O_3 external scale with alloys that are not already good Cr_2O_3 formers. Some, La, Y and especially Ca oxides, could locally enhance the Cr_2O_3 formation on Co-25Cr at 1000°C, but lost their effectiveness at 1100°C. This effect was sensitive to the amount of applied oxides. The implanted Y or La also had no effect on the oxidation of Co-15Cr but showed a little effect on the Co-25Cr. The surface oxides appeared to be most beneficial on the established Cr_2O_3 forming alloy. Implantation of Y and La produced essentially the same effects as the beneficial surface-applied oxides.

13771 **(MINTEK-M—270) A literature review of the properties and uses of vanadium in engineering alloys and of vanadium carbide.** Paton, R.; Luyckx, S. (University of the Witwatersrand, Johannesburg (South Africa)). 29 Aug 1986. 44p. NTIS (US Sales Only)03/MF A01. File Number DE87900462.

The main use of vanadium is in the manufacture of alloy steels, particularly the high-strength low-alloy types. Apart from its use in non-ferrous alloys, the consumption of vanadium outside the steel industry is very limited. Vanadium is little used in stainless steels, and it is recommended that research should be undertaken towards the development of a general-purpose ferritic stainless steel containing both molybdenum and vanadium. Vanadium-based cemented carbides can replace alloys based on tungsten carbide in applications where resistance to mechanical and thermal shock is not an important criterion. Research should be started in South Africa in the field of vanadium carbide coatings.

13772 **(N—86-31699) Low cycle fatigue behavior of a plasma-sprayed coating material.** Gayda, J.; Gabb, T.P.; Miner, R.V. Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 17p. (NASA-TM—87318; E—3050; NAS—1.15:87318; CONF-860340—12). NTIS HC A02/MF A01.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Single crystal nickel-base superalloys employed in turbine blade applications are often used with a plasma spray coating for oxidation and hot corrosion resistance. These coatings may also affect fatigue life of the superalloy substrate. As part of a large program to understand the fatigue behavior of coated single crystals, fully reversed, total strain controlled fatigue tests were run on a free standing NiCoCrAlY coating alloy, PWA 276, at 0.1 Hz. Fatigue tests were conducted at 650 C, where the NiCoCrAlY alloy has modest ductility, and at 1050 C, where it is extremely ductile, showing tensile elongation in excess of 100 percent. At the lower test temperature, deformation induced disordering softened the NiCoCrAlY alloy, while at the higher test temperature cyclic hardening was observed which was linked to gradual coarsening of the two phase microstructure. Fatigue life of the NiCoCrAlY alloy was significantly longer at the higher temperature. Further, the life of the NiCoCrAlY alloy exceeds that of coated, /001/-oriented PWA 1480 single crystals at 1050 C, but at 650 C the life of the coated crystal is greater than that of the NiCoCrAlY alloy on a total strain basis.

13773 **(N—86-31702) Effect of variations of cobalt content on the cyclic oxidation resistance of selected Ni-base superalloys.** Barrett, C.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1986. 24p. (NASA-TM—87297; E—2952; NAS—1.15:87297; CONF-860340—13). NTIS HC A02/MF A01.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

Cobalt levels were systematically varied in the Ni-base turbine alloys U-700 (cast), U-700m(PM/HIP), Waspaloy, Mar-M-247, In-738, Nimonic-115, U-720, and SX-R-150. The cobalt levels ranged from 0 wt % to the nominal commercial content in each alloy. The alloys were tested in cyclic oxidation in static air at 1000, 1100 and 1150 C for 500, 200 and 100 hr respectively. An oxidation attack parameter, Ka derived from the specific weight change versus time data was used to evaluate the oxidation behavior of the alloys along with X-ray diffraction analysis of the surface oxides. The alloys tend to form either Cr_2O_3/chromite spinel or Al_2O_3/aluminate spinel depending on the CR/Al ratio in the alloys. Alloys with a ratio of 3.5 or higher tend to favor the Cr oxides while those under 3.0 form mostly Al oxides. In general the Al_2O_3/aluminate spinel forming alloys have the better oxidation resistance. Increased cobalt content lowers the scaling resistance of the higher Cr alloys while a 5.0 wt % Co content is optimum for the Al controlling alloys. The refractory metals, particularly Ta, appear beneficial to both types of oxides perhaps due to the formation of the omni-present trirutile Ni(Ta,Cb,Mo,W)2O6. Both scales break down as increasing amounts of NiO is formed.

13774 **(N—86-32557) Creep properties of PWC-11 base metal and weldments as affected by heat treatment.** Titran, R.H.; Moore, T.J.; Grobstein, T.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 19p. (NASA-TM—88842; E—3227; NAS—1.15:88842; CONF-860340—14). NTIS HC A02/MF A01.

From 115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting; New Orleans, LA, USA (2 Mar 1986).

In a preliminary study using single specimens for each condition, PWC-11 (a niobium-base alloy with a nominal composition of Nb-1%Zr-0.1%C) was creep tested at 1350 K and 40 MPa. Base metal specimens and specimens with transverse electron beam welds were tested with and without a 1000 hr, 1350 K aging treatment prior to testing. In the annealed condition (1 hr at 1755 K + 2 hr at 1475 K), the base metal exhibited superior creep strength compared to the nonaged condition, reaching 1 percent strain in 3480 hr. A 1000 hr, 1350 K aging treatment prior to creep testing had a severe detrimental effect on creep strength of the base metal and transverse electron beam weldments, reducing the time to attain 1 percent strain by an order of magnitude. Extrapolated temperature compensated creep rates indicate that the present heat of PWC-11 may be four times as creep resistant as similarly tested Nb-1%Zr. The extrapolated stress to achieve 1 percent creep strain in 7 yr at 1350 K is 2.7 MPa for annealed Nb-1%Zr and 12 MPa for annealed and aged PWC-11 base metal with and without a transverse electron beam weld.

13775 **(N—87-10399) Ultrasonic determination of recrystallization.** Generazio, E.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 15p. (NASA-TM—88855; E—3248; NAS—1.15:88855; CONF-8608142—1). NTIS, PC A02/MF A01.

From Review of progress in quantitative NDE; La Jolla, CA, USA (3 Aug 1986).

Ultrasonic attenuation was measured for cold worked Nickel 200 samples annealed at increasing temperatures. Localized dislocation density variations, crystalline order and colume percent of recrystallized phase were determined over the anneal temperature range using transmission electron microscopy, x-ray diffraction, and metallurgy. The exponent of the frequency dependence of the attenuation was found to be a key variable relating ultrasonic attenuation to the thermal kinetics of the recrystallization process. Identification of this key variable allows for the ultrasonic determination of onset, degree, and completion of recrystallization.

13776 **(N—87-11010) Evaluation of Ti-6Al-4V surface treatments for use with a polyphenylquinoxaline adhesive.** Progar, D.J. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1986. 20p. (NASA-TM—89045; NAS—1.15:89045). NTIS, PC A02/MF A01.

Three surface treatments for Ti-6Al-4V adherends were evaluated using a thermoplastic polymer monoether polyphenylquinoxaline, MEPPQ, which had been shown in previous studies to have good potential as a high temperature adhesive for aerospace applications. Initial results based on long term thermal exposure at 232 C (450 F) using the phosphate-fluoride (PF) and chromic acid anodized (CAA) treatments with MEPPQ adhesive were not encouraging. A significant improvement in strength retention and a change in failure mode (cohesive) at 232 C (450F) was found for the SHA treated specimens compared to the PF and CAA treatments. Although an improvement in long term thermal durability was obtained with the SHA treatment of Ti-6Al-4V, an improved surface treatment with better long term durability is still required for aerospace applications.

13777 **(SAND—86-0481C) Design of high thermal expansion glass-ceramics through microstructural control.** Loehman, R.E.; Headley, T.J. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1986. Contract AC04-76DP00789. 12p. (CONF-860714—7). NTIS, PC A02/MF A01. File Number DE87003787.

From 22. University conference on ceramics - ceramic microstructures '86: role of interfaces; Berkeley, CA, USA (28 Jul 1986).

High thermal expansion glass-ceramics can be made from lithium silicate glasses that contain small amounts of P_2O_5. The essential step involves heating the glass to a temperature near 1000°C to grow well-faceted 0.1 to 0.5 μm Li_3PO_4 crystallites in the molten glass matrix. When the temperature is lowered to the 750 to 850°C range, a mixture of high expansion SiO_2 polymorphs and lithium silicate phases crystallize. TEM observations on one composition reveal the crystallization is by epitaxial growth on specific faces of the Li_3PO_4 crystallites. Heat treatments that do not form faceted Li_3PO_4 crystallites give glass-ceramics with much lower expansion coefficients. Our understanding and control of this epitaxial crystallization and growth mechanism has led to the development of a family of high thermal expansion glass ceramics useful for making hermetic seals with a number of stainless steels and superalloys.

13778 **(SAND—86-0936C) Use of the double-loop reactivation test to measure sensitization in aged and welded pH 13-8 Mo martensitic stainless steel.** Cieslak, W.R.; Cieslak, M.J.; Hills, C.R. (Sandia National Labs., Albuquerque, NM (USA)). 8 Jan 1987. Contract AC04-76DP00789. 22p. (CONF-870314—6). NTIS, PC A02. File Number DE87003508.

From Corrosion '87; San Francisco, CA, USA (9 Mar 1987).

Electrochemical potentiokinetic reactivation (EPR) testing provides quantitative detection of small degrees of sensitization. We have used double-loop (DL-EPR) testing, a method which has been characterized for use on austenitic stainless steels, to measure sensitization resulting from aging or from welding of PH 13-8 Mo martensitic stainless steel. Aging at either 500°C or 620°C results in an increase of the reactivation current density. The 500°C treatment promotes preferential susceptibility to corrosion along prior austenite grain boundaries, and the 620°C treatment promotes preferential susceptibility along martensite interlath boundaries. A narrow band in the heat-affected zone of autogenous weldments also undergoes localized corrosion during the reactivation scan. Increased reactivation current density is likely caused by classic Cr-depletion resulting from carbide precipitation.

13779 **(SAND—86-1343C) Phase selection during pulsed laser annealing of Fe-V alloys.** Perepezko, J.H.; Follstaedt, D.M.; Peercy, P.S. (Sandia National Labs., Albuquerque, NM (USA); Wisconsin Univ., Madison (USA)). 1986. Contract AC04-76DP00789. 7p. (CONF-861207—36). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003507.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Pulsed laser melting of the low-temperature σ (tetragonal, D8/sub b) phase has been used to generate a liquid undercooled with respect to the melting point of the higher temperature, equilibrium α (bcc) solid solution in equiatomic Fe-V alloys. From calculations based on reported thermodynamic data and equilibrium transformation temperatures, the metastable melting point of the σ phase is about 1720°K for an Fe-50 at.% V alloy, which is 54°K below the melting temperature of the α phase. During rapid heating of well-annealed σ-phase material with a 30 ns laser pulse to above melt threshold the $\sigma \rightarrow \alpha$ reaction is suppressed, so that the melt zone is undercooled by ~54°K with respect to the equilibrium α phase. The α phase nucleates from the undercooled molten surface layer and is retained during the subsequent rapid cooling (~10^{10} K/s) because of the relatively sluggish $\alpha \rightarrow \sigma$ transformation. X-ray diffraction (Read camera) and TEM identified the α phase in the near-surface after melting σ with incident laser energies (1.0-1.41 J/cm²) which are well above the melt threshold as determined by changes in reflectivity (~0.7 J/cm²). The α phase nucleated from the undercooled liquid within ~20 ns.

13780 **(UCRL—95842) Metallic lithium by quantum Monte Carlo.** Sugiyama, G.; Zerah, G.; Alder, B.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 11p. (CONF-860864—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003820.

From Meeting on strongly coupled plasma physics; Santa Cruz, CA, USA (4 Aug 1986).

Lithium was chosen as the simplest known metal for the first application of quantum Monte Carlo methods in order to evaluate the accuracy of conventional one-electron band theories. Lithium has been extensively studied using such techniques. Band theory calculations have certain limitations in general and specifically in their application to lithium. Results depend on such factors as charge shape approximations (muffin tins), pseudopotentials (a special problem for lithium where the lack of rho core states requires a strong pseudopotential), and the form and parameters chosen for the exchange potential. The calculations are all one-electron methods in which the correlation effects are included in an ad hoc manner. This approximation may be particularly poor in the high compression regime, where the core states become delocalized. Furthermore, band theory provides only self-consistent results rather than strict limits on the energies. The quantum Monte Carlo method is a totally different technique using a many-body rather than a mean field approach which yields an upper bound on the energies. 18 refs., 4 figs., 1 tab.

13781 **(Y—2358) Assessment of electrochemical potentiokinetic reactivation tests to qualify stainless steel for nitric acid service.** Olsen, A.R.; Dillon, J.J.; Peters, A.H.; Clift, T.L. (Oak Ridge Y-12 Plant, TN (USA)). 31 Dec 1986. Contract AC05-84OS21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87004775.

To minimize the costs and delivery time delays associated with purchasing type 304L stainless steel materials for service in nitric-acid-containing media, an alternative to the current Oak Ridge Y-12 Plant requirement of testing in accordance with American Society for Testing and Materials (ASTM) A 262, Practice C (the boiling nitric acid test), is being sought. A possible candidate is the electrochemical potentiokinetic reactivation (EPR) test being developed for the nuclear industry and under consideration for acceptance as an ASTM standard. Based on a review of the literature and some limited screening tests, this test, as currently proposed, is not a suitable substitute for the nitric acid test. However, with additional development the EPR test is a likely candidate for providing a quantitative substitute for the current qualitative oxalic acid etching (ASTM A 282, Practice A) often used to accept, but not reject, materials for use in a nitric acid medium.

13782 **(Y—2359) Characterization of uranium surfaces machined with aqueous propylene glycol-borax or perchloroethylene-mineral oil coolants.** Cristy, S.S.; Bennett, R.K. Jr.; Dillon, J.J.; Richards, H.L.; Seals, R.D.; Byrd, V.R. (Oak Ridge Y-12 Plant, TN (USA)). 31 Dec 1986. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004569.

The use of perchloroethylene (perc) as an ingredient in coolants for machining enriched uranium at the Oak Ridge Y-12 Plant has been discontinued because of environmental concerns. A new coolant was substituted in December 1985, which consists of an aqueous solution of propylene glycol with borax (sodium tetraborate) added as a nuclear poison and with a nitrite added as a corrosion inhibitor. Uranium surfaces machined using the two coolants were compared with respects to residual contamination, corrosion or corrosion potential, and with the aqueous propylene glycol-borax coolant was found to be better than that of enriched uranium machined with the perc-mineral oil coolant. The boron residues on the final-finished parts machined with the borax-containing coolant were not sufficient to cause problems in further processing. All evidence indicated that the enriched uranium surfaces machined with the borax-containing coolant will be as satisfactory as those machined with the perc coolant.

13783 **Dissolution of glassy Ni-P alloys in H/sub 2/SO/sub 4/ and HCl electrolytes.** Diegle, R.B.; Sorensen, N.R.; Nelson, G.C. (Sandia National Labs., Albuquerque, NM 87185). *Journal of the Electrochemical Society;* **133**: No. 9, 1769-1776(Sep 1986). Contract AC04-76DP00789.

The effect of alloyed P on the dissolution of Ni was investigated with glassy Ni-P alloys. The anodic behavior of Ni-P in 0.2N H/sub 2/SO/sub 4/ and 0.2N HCl differed substantially from that of Ni. In 0.2N H/sub 2/SO/sub 4/, glassy Ni-P passivated at potentials up to several hundred mV anodic to E/sub oc/ whereas Ni dissolved in the active state at comparable anodic overpotentials. At higher overpotentials, Ni-P underwent transpassive dissolution,

but Ni passivated. The behavior of Ni-P in 0.2N HCl was virtually identical to that in 0.2N H/sub 2/SO/sub 4/, but Ni pitted severely in 0.2N HCl at small anodic overpotentials. The kinetics of passivation of Ni-P did not vary over a range of chloride concentration from 0.2 to 3.0N, and the alloy completely resisted chloride-induced pitting at potentials below about 800 mV(SCE). Coulometric and gravimetric measurements indicated that during dissolution of Ni-P at passive potentials, the P was not oxidized as completely as it was during polarization at transpassive potentials.

13784 **Resistive critical current transition in composite superconductors.** Warnes, W.H. Madison, WI; Univ. of Wisconsin (1986). 286p. University Microfilms Order No. 86-14,403.

Thesis (Ph. D.).

The development and improvement of technological high current superconducting composite wires relies on understanding the correlation between the microstructure of the superconductor and its critical current. The standard four point resistive measurement of the voltage-current characteristic to obtain the critical current does not yield an unambiguous value for the critical current. Instead, the sample exhibits a transition that is quite broad in current. The breadth of this transition is due to the inhomogeneous nature of the sample and can be described by a distribution of critical currents throughout the wire. This study develops models for the resistive critical current transition incorporating a distribution of critical currents in the sample. Separate models are developed for monofilamentary and multifilamentary composite superconductors. Comparisons between the predictions of the model and the experimental measurements show good agreement for broad range of conductors. The models can be used to derive physical parameters of the critical current transition. These parameters include the average critical current the width of the critical current distribution, and the wavelength of the weak links. The models can also be used to examine the effects of filament inhomogeneities on the critical current and to determine the extent to which the critical current has been limited by macroscopic, extrinsic effects in the composite.

13785 **Effect of microstructure on helium bubble growth in irradiated nickel.** Sattler, M.L. Charlottesville, VA; Univ. of Virginia (1986). 245p. University Microfilms Order No. 86-08,544.

Thesis (Ph. D.).

Thin nickel films were irradiated with 80 keV helium ions at varying doses and varying temperatures in order to obtain a variety of final microstructures. The growth of bubbles was examined during in-situ irradiations at 950°C where migration and coalescence events were observed for bubbles as large as 60 nm. Further direct observations of bubble growth were made during annealing of the irradiated specimens. For sample with no visible bubbles before annealing, the heating to 0.51 T/sub M/ produced bubbles that increased in diameter with annealing time to the power n. For bubbles in the grain interior, $n \sim 1$, and on the grain boundaries, $n \sim 0.6$. Since no migration and coalescence or ripening theories predict this behavior, a theory described by transient diffusion to spherical sinks was developed to discuss the behavior. This theory predicts that $n = 1$ for bubbles growing in the grain interior and $n = 0.5$ for bubbles on the grain boundary. In other annealing of irradiated samples containing large bubble populations, the growth of large bubbles and shrinking of small bubbles was observed at a temperature equal to 0.54 T/sub M/. The theory of Ostwald ripening properly described this type of bubble growth. Mass spectrometer measurements of He content in the irradiated specimens showed a greater He retention in the Ni films that contained a significant bubble population than those with no visible bubbles.

13786 **Mechanisms of helium embrittlement.** Gerke, R.D. Charlottesville, VA; Univ. of Virginia (1986). 180p. University Microfilms Order No. 86-08,542.

Thesis (Ph. D.).

In fusion reactor environment, transmutation reactions occur that produce helium when neutrons from the plasma strike the containment first wall. This dissolved helium in the metal together with the neutron induced damage leads to premature, intergranular failure. In an attempt to clarify the role of helium in promoting high temperature intergranular failure, in situ tensile experiments were conducted in a high voltage electron microscope (HVEM) attached to a linear ion accelerator used at 80 keV. Two types of experiments were performed on 14-MeV neutron and helium irradiated 40-μm thick foil stainless steel specimens using a heating quantitative load elongation tensile stage between 25 and 700°C. A graph of cumulative crack length plotted against total specimen elongation exhibits a slope, S, which increases as specimen ductility (reduction of area, ROA) decreases. It was found that $ROA^2 \times S = 0.4$ for all cases studied. High temperature helium embrittlement occurs only at slow strain rates. Dislocations dragging helium bubbles to grain boundaries is commonly thought to cause the embrittlement. Specimens tensile tested under dual tensile test temperatures exhibited integranular failure at 700°C and after the tensile test was resumed at 550°C charged to a transgranular failure mode.

13787 **Transmission electron microscopy study of phase transformations in ternary Ni_4Mo-based alloys containing 0 to 4 weight percent chromium.** Vasudevan, K. Knoxville, TN; Univ. of Tennessee (1986). 411p. University Microfilms Order No. 86-24,275.

Thesis (Ph. D.).

Phase transformations in the binary Ni_4Mo alloy and ternary Ni_4Mo alloys containing 0 to 4 wt% chromium are reported using electric resistivity and microhardness measurements, optical scanning, and transmission electron microscopy (TEM). The transformation behavior was studied by resistivity measurements during continuous heating, cooling, or isothermally. The isothermal transformation behavior was also investigated in alloys aged at 600, 700, 800, and 850°C for times to 4500 hours. The resistivity changes associated with short range order (SRO) and long-range order (LRO) in Ni_4Mo have been completely characterized. The negative temperature coefficient of resistivity that is observed in the SRO state, and the change in slope of the LRO resistivity-temperature curve are explained on the basis of s-d electron scattering. The {111} and {110} fcc striations observed in the optical microstructure of ordered Ni_4MO were studied using TEM and explained on the basis of structural considerations. The isothermal transformation behavior of ternary Ni_4Mo alloys containing chromium in the range 2 to 4 wt% aged at 850, 800, 700, and 600°C was studied. A variety of Mo-rich second phases, such as DO_{22}, Ni_3Mo, Ni_2MO, and eta-carbides is observed.

13788 **Surface chemical properties of Ag/Pt(111): comparisons between electrochemistry and surface science.** Paffett, M.T.; Campbell, C.T.; Taylor, T.N. (Los Alamos National Lab., NM). *Langmuir;* **1**: No. 6, 741-747(1985).

The growth modes and interaction of vapor-deposited Ag on a clean Pt(111) surface have been monitored by Auger electron spectroscopy (AES), low-energy electron diffraction (LEED), work function measurements, thermal desorption mass spectroscopy (TDMS), and chemisorption of H_2 and CO. The AES data indicate that at ≧ 260 K Ag grows in a uniform monolayer up to about one monolayer and that at larger coverages three-dimensional island growth occurs (i.e., Stranski-Krastanov mechanism). In the submonolayer region above ~ 260 K, LEED data indicate that Ag grows in p(1 x 1) islands one atom thick. In the second layer Ag growth assumes a Ag(11) lattice spacing, rotationally commensurate with the underlying Pt(111) substrate. The change in work function (Δphi) indicates that the annealed Ag/Pt(111) surfaces of theta/sub Ag/ ≧ 2.0 achieve a work function value more negative than smooth Ag(111), consistent with the microscopic surface roughness for three-dimensional island growth. An irreversible increase in the work function at ~ 225 K indicates that Ag adatoms became mobile and form larger islands at this temperature and that vapor deposition at temperatures below this results in much rougher surfaces, concomitant with lower work functions. Analysis of the TDMS data for Ag/Pt(111) indicates that for theta/sub Ag/ < 1.0 Ag desorbs in a single state with an activation energy (E/sub d/) of 70.6 kcal mol^{-1}. For theta/sub Ag/ > 1.0, a second multilayer desorption peak appears with E/sub d/ equal to the sublimation energy of Ag (66.8 kcal mol^{-1}). Due to the island growth mechanism, Ag causes simple one-to-one site blocking of the Pt(111) surface for H_2 and CO chemisorption. Comparisons with the underpotential decomposition of Ag onto Pt electrodes indicate that the underpotential contains roughly equal contributions from differences in metal-metal bond stability and metal-solution bonding.

13789 Crystal site occupancy of alloying elements in polycrystalline Nb_3Sn superconductors by electron channeling. Tafto, J.; Sabatini, R.L.; Suenage, M. (Brookhaven National Lab., Upton, NY). pp 196-199 of Proceedings of the 43rd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1985). Contract AC02-76CH00016.

The technique of electron channeling called ALCHEMI (Atom Location by Channeling Enhanced Microanalysis) has been used to study composite materials by determining the crystal sites of small amounts of alloying elements in Nb_3Sn produced by the bronze process. The effects of Ti and Ta have been reported previously. In this study it was found that V and Mo occupy the Nb-site in bronze processed Nb_3Sn, but the situation is still not defined for small amounts of Zr going into the compound. From this and previously reported data, there appears to be no direct relationship between site occupancy of the alloying element and increased magnetic field. 8 references, 5 figures.

13790 Energetic cluster ion impacts on carbon and gold/carbon films. Ledbetter, M.C.; Matthew, M.W.; Beuhler, R.J.; Friedman, L. (Brookhaven National Lab., Upton, NY). pp 384-385 of Proceedings of the 43rd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1985).

Carbon films and carbon films coated with gold have been bombarded with water clusters of 25 to 100 molecules accelerated to 300 kV. Clusters of 100 molecules produced craters of approximately 7-8 nm in diameter; 50 molecules produced craters of approximately 1.5-2 nm in diameter; while clusters of 25 molecules failed to produce any noticeable effects on the films. The effects of the thin layer of gold was to both absorb the cluster energy and to scatter cluster atoms or molecules containing hydrogen and oxygen through relatively wide angles in the projectile penetration process. 2 figures.

13791 Approximate formulas for the amplitude and the phase of the infrared reflectance of a conductor. Modine, F.A.; Smith, D.Y. (Oak Ridge National Lab., TN). *Journal of the Optical Society of America;* **1**: No. 12, 1171-1174(Dec 1984). Contract AC05-84OR21400.

Approximate formulas are derived for the amplitude and the phase of the specular-reflection coefficient at normal incidence of infrared light from a conductor. The nature and the accuracy of the approximations are established. 7 references, 1 figure.

13792 Two-dimensional modeling of conduction-mode laser welding. Russo, A.J. (Sandia National Labs., Albuquerque, NM). pp vp. of Technical digest of ICALEO, 84. Toledo, OH; Laser Institute of America (1984). (CONF-8411100—).

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

WELD2D is a two-dimensional finite difference computer program suitable for modeling the conduction-mode welding process when the molten weld pool motion can be neglected. The code is currently structured to treat butt-welded geometries in a plane normal to the beam motion so that dissimilar materials may be considered. The surface heat transfer models used in the code include a Gaussian beam or uniform laser source, and a free electron theory reflectance calculation. Temperature-dependent material parameters are used in the reflectance calculation. Measured cold reflection data are used to include surface roughness or oxide effects until melt occurs, after which the surface is assumed to be smooth and clean. Blackbody reradiation and a simple natural convection model are also included in the upper surface boundary condition. Either an implicit or explicit finite-difference representation of the heat conduction equation in an enthalpy form is solved at each time step. This enables phase transition energies to be easily and accurately incorporated into the formulation. Temperature-dependent 9second-order polynominal dependence) thermal conductivities are used in the conduction calculations. Constant values of specific heat are used for each material phase. At present, material properties for six metals are included in the code. These are: aluminium, nickel, steel, molybdenum, copper and silicon.

13793 The effect of angle of incidence on plasmas generated during laser welding. Dixon, R.D.; Lewis, G.K. (Los Alamos National Lab., P.O. Box 1663, MS G770, Los Alamos, NM). pp vp. of Technical digest of ICALEO, 84. Toledo, OH; Laser Institute of America (1984). (CONF-8411100—).

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

This study was designed to address the first question and infer an answer to the second. A 400 watt average power pulsed Nd-YAG laser was used to irradiate commercially pure aluminum (1100 aluminum). Radiation was done at several angles of incidence and the resulting plasma monitored using a high speed video camera (12000 pictures per second). The plasma initiation was also monitored optically using a photomultiplier tube and acoustically using microphones. The laser pulse shape was monitored by detecting radiation from a partially transmitting mirror of the rear of the cavity.

13794 Laser beam diagnostics for metalworking applications. Ramos, T.J.; Lingenfelter, A.C. (Lawrence Livermore National Lab., Livermore, CA). pp vp. of Technical digest of ICALEO, 84. Toledo, OH; Laser Institute of America (1984). (CONF-8411100—).

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

The Materials Fabrication Division of Lawrence Livermore National Laboratory (LLNL) has three pulsed Nd-YAG lasers dedicated to metalworking. The units are used in a job shop primarily for welding. They also have a number of applications requiring cutting and drilling capability. Each of these metalworking operations requires somewhat different laser beam characteristics. As most investigators have found, the mode of the laser beam and the mode stability are the key variables which must be controlled if optimum results are to be achieved. The authors use several techniques to observe and measure these variables, i.e. Charge Couple Device (CCD) Camera, Thermal Image Plate and thermal-sensitive paper.

13795 Optimized predictions for heats of formation of transition-metal alloys II. Watson, R.E.; Bennett, L.H. (Brookhaven National Lab., Upton, NY). *CALPHAD: Computer Coupling of Phase Diagrams and Thermochemistry;* **8**: No. 4, 307-321(1984). Contract AC02-76CH00016.

A simple Friedel type d-band model of alloy enthalpies of formation has been used in an interpolation scheme, fitted to experimental data, to obtain heats for the 50/50 transition-metal alloys. This present fit employs a data base which is substantially improved over the one used previously in this journal. The fit has also been extended to include La and Th alloys. The rms error in the fit, for the set of alloys for which there is experimental enthalpy, is the same as the rms uncertainty in that data. Granted this, these enthalpy values should be of use in the thermodynamic predictions of phase diagrams for which there is no experimental data. 18 references, 4 figures, 2 tables.

13796 Segregation of Zn solutes to high-angle (001) twist grain boundaries in Al. Wolf, D.; Lam, N.Q. (Argonne National Lab., IL). *Materials Research Society Symposia Proceedings;* **25**: 279-286(1984).

The energies of the $\Sigma = 5$, 13, and 17 (001) coincident site lattice (CSL) twist boundaries in Al containing small amounts of Zn solutes have been calculated using an iterative energy minimization technique in conjunction with interatomic potentials derived entirely from first principles. By determining both the energies of substitution in the bulk and in different sites in the boundary, the site selectivity for Zn segregation at the grain boundary has been investigated. In the lattice plane immediately near the grain boundary, Zn solutes were found to prefer the lower-symmetry non-coincidence sites while, in the next plane, substitution in the coincidence sites is preferred. The effect of Zn-Zn interactions has also been considered for small solute concentrations. It is found that the magnitude of the Zn-Zn interaction energy is remarkably insensitive to the particular sites occupied by the Zn atoms as well as the detailed geometry of the interface. 10 references, 2 figures, 2 tables.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 13730, 14006

13797 **(AD-A—173099/3/XAB) Fabrication of electrically conductive metal oxide coatings by reactive ion plating.** Hock, V.F.; Stephenson, L.D.; Givens, J.H.; Rigsbee, J.M. (Illinois Univ., Urbana (USA). Dept. of Material Science). Dec 1985. 6p. NTIS, PC A02/MF A01.

Electrically conductive metal-oxide (ceramic) coatings produced by reactive ion plating are being investigated at USA-CERL for potential application in cathodic-protection systems. Ceramic materials are advantageous because of their low dissolution rates (typically less than 1 g/A/yr in 3.5% NaCl solution) and ease of fabrication. Among the ceramic anode materials currently under investigation are two systems: (1) a mixture of titanium oxide and ruthenium oxide and (2) a mixture of titanium oxides doped with niobium, each ion plated on niobium substrates. The mixed-oxide coatings were fabricated by a reactive-ion-plating process involving oxygen and dual electron-beam evaporation sources. An enhanced plasma was used to increase reactivity. X-ray diffraction, scanning electron microscopy, and energy-dispersive x-ray spectroscopy were used for characterization of the microstructure, crystallography, and elemental composition of the coating.

13798 **(AD-A—174530/6/XAB) Ultralow-thermal-expansion ceramics. Final report, July 1983-June 1986.** McKinstry, H.A.; Agrawal, D.K.; Lenain, G.E.; Vikram, C.S.; Limaye, S.Y. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). 11 Aug 1986. 16p. NTIS, PC A02/MF A01.

The crystal chemistry, synthesis, and thermal-expansion investigation of the NZP-family was completed - in that $MZr_2P_3O_{12}$ (M = Li, Na, K, Rb, Cs), $MZr_4P_6O_{24}$ (M = Mg, Ca, Sr, Ba) and a few more compositions were studied. Single crystals of (NZP) and (CZP) were grown, and high-temperature x-ray measurements were made on these crystals to test the validity of a structural model to interpret thermal expansion data. The possibility of the development of a glass-ceramic of $NaGe_2P_3O_{12}$ was explored. Dielectric measurements made on $CaZr_4P6O_{24}$ revela that in general (NZP)-materials have a low dielectric constant. Three new families, namely diborides (ZrB_2, TiB_2, and CrB_2), Al_2O_3-GeO_2 system and perovskite $Pb(Mg1/3Nb2/3)O_3$ were investigated in order to search for any new low thermal expansion composition, but not much success was achieved in this direction, except that some perovskite compositions displayed low alpha behavior at low temperatures.

13799 **(CONF-841250—2) Erosion damage in structural ceramics.** Ritter, J.E. (Massachusetts Univ., Amherst (USA). Dept. of Mechanical Engineering). 16 Dec 1984. Contract AC02-81ER10950. 7p. Elsevier Sequoia. File Number TI87003340.

From International conference on engineering ceramics; Jerusalem, Israel (16 Dec 1984).

The erosion damage (material removal and strength degradation) in a variety of structural ceramics (Al_2O_3, SiC, Si_3N_4 and MgO) as a function of kinetic energy of the impacting particle is compared. Based on this data an erosion damage model is developed by assuming that the kinetic energy of the impacting particle goes into grain boundary cracking and the subsequent grain fall-out creates a hemispherical pit with an annual crack of about a grain diameter in size. The model predicts that, as kinetic energy increases, larger pits are formed; however, the ratio of the annular crack to pit size decreases, causing the stress intensity factor for this pit-crack defect to become insensitive to the size of the pit. Thus, strength degradation is predicted to level off at high kinetic energies. The dependence of the erosive wear data on the kinetic energy of the impacting particle and the grain size and toughness of the target material agreed well with the model, as well as the strength degradation results of sintered Al_2O_3. However, the post-erosion strength of sintered SiC showed an increase at high impacting kinetic energies. This discrepancy was thought to be related to the fact that, in SiC, relatively shallow, rather than hemispherical, pits were formed on erosion.

13800 **(CONF-850415—5) Erosion and strength degradation in alumina.** Ritter, J.E.; Rosenfeld, L.; Jakus, K. (Massachusetts Univ., Amherst (USA). Dept. of Mechanical Engineering). 1985. Contract AC02-81ER10950. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003341.

From 4. international conference on wear of materials; Vancouver, Canada (14 Apr 1985).

The effect of multiparticle impact at 23, 700, 1000°C on the erosion and strength degradation of sintered alumina was determined. Impact damage at normal incidence was characterized by numerous small pits consistent with grain boundary cracking. Neither erosion rate nor strength degradation for normal impingement depended strongly on temperature. Although erosion rate increased with increasing kinetic energy of the impacting particle, strength degradation leveled off at high kinetic energies, contrary to predictions based on elastic/plastic fracture. An alternative theory was developed based on the observed damage morphology. This theory assumes that the kinetic energy of the impacting particle goes into grain boundary cracking and the subsequent grain fallout creates a hemispherical pit with an annular crack. This model correctly predicts the dependency of both erosion rate and strength degradation on kinetic energy of the impacting particle. For impingement at low angles impact damage was primarily by a ductile plowing process. This caused erosion rates to be greater than that predicted based on the brittle chipping mode of erosion, but strength degradation was less because the shallow, elongated flaws are less severe than the pits produced by normal impact.

13801 **(CONF-8608144—1) Grain boundaries in ceramics and ceramic-metal interfaces.** Clarke, D.R.; Wolf, D. (IBM Research Div., Yorktown Heights, NY (USA); Argonne National Lab., IL (USA)). 1986. Contract W-31109-ENG-38. 23p. NTIS, PC A02/MF A01. File Number DE87001514.

From Panel study on bonding and adhesion at solid state interfaces for the Council on Materials Science; Aspen, CO, USA (11 Aug 1986).

Three interfaces exist: the crystal-crystal grain boundary in very pure single-phase ceramics, the crystal-glass-crystal grain boundary in most single-phase and polyphase ceramics, and the ceramic-metal interface. It is needed to correlate their structure and adhesion/failure. Methods for studying the bonding, interfacial structure, and fracture and adhesion are discussed, and recommendations are given. 42 refs. (DLC)

13802 **(ISL-CO—28/85) Single sideband suppressed carrier (SSBSC) interferometer for the measurement of dielectric properties of laser heated materials.** Pierson, J. (Institut Franco-Allemand de Recherches de Saint-Louis, 68 (France)). Oct 1985. 10p. (ETN—86-97630; CONF-8509351—1). NTIS HC A02/MF A01.

From 15. European microwave conference; Paris, France (9 Sep 1985).

A method to measure the dielectric properties of ceramic materials at high temperatures is described. The device is a Ka band microwave bridge which uses a single sideband suppressed carrier signal as reference. A carrier modulated by ferrite modulator around its maximum insertion loss gives a double sideband suppressed carrier signal. By addition of two such signals the SSBSC is obtained. The high rejection of the carrier and the other sideband gives results with the required accuracy. By this method the temperature range of dielectric measurements is extended to 2500 K.

13803 **(KFK—4096) High temperature creep and slow crack growth properties of HPSN as an example of ceramics containing a glassy phase.** Bethge, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Jun 1986. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87751171.

A study was made of the kinetics of creep and slow crack growth at high temperatures in ceramic materials containing a glassy boundary phase (for experiments: bend tests). The materials studied were hot pressed silicon nitride (HPSN) containing either MgO or Y/sub 2/O/sub 3/ as additives and, for comparison pur-

poses, hot isostatically pressed silicon carbide with no grain boundary phase. It will be shown that the kinetic of creep in HPSN can be explained in terms of a mechanical two phase model. Grain boundary voids grow in response to grain boundary sliding and the nucleation of such voids is stress independent. The stress exponent in the Norton Law is thus dependent on the kind of experiment considered (static, dynamic or strain controlled). The model describing the kinetic of creep is based on the elastic behaviour during the creep test; hardening due to increasing grain linkage, softening due to creep porosity. A crack, for example in a ceramic material, will grow providing both that the growth is thermodynamically possible and that the stresses at the crack tip exceed the cohesive strength. The stress criterion, however, loses its significance in materials undergoing creep or viscous flow; crack growth will occur wherever the free energy of the sample is thereby lowered. In two phase ceramics at high temperatures the assumed mechanism for the slow crack growth is the nucleation and growth of voids or microcracks in the stress field in front of a crack and throughout the sample. If the stress dependency of the nucleation of voids is the same as that for their annihilation, then the crack growth velocity and the stress relaxation behaviour under constant strain can be described by the same parameters.

13804 **(LBL—22367) TEM [transmission electron microscopy] investigation of orthorhombic-type phases in stabilized zirconias.** Bielicki, T.A.; Dahmen, U.; Thomas, G.; Westmacott, K.H. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 14p. (CONF-860968—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003523.

From 3. international conference on the science of technology of zirconia; Tokyo, Japan (9 Sep 1986).

The crystal structures of the thin-foil orthorhombic phases of zirconia have been investigated by microdiffraction and high-resolution transmission electron microscopy in MgO-PSZ and Y_2O_3-TZP. In the latter material, a slight distortion from orthorhombic symmetry was apparent. The structure there is believed to be rhombohedral but with the same layered and shear-faulted character as in MgO-PSZ. Image simulation of the orthorhombic phase with the ~(5x5x5)A unit cell was performed, based on a domain structure in which O/sub I/ atoms can occupy either obverse or reverse positions, as suggested in a previous x-ray structure refinement. Simulated and experimental images were in good agreement. A structure is proposed for the orthorhombic phase with the ~(10x5x5)A unit cell, consisting of a planar arrangement of obverse and reverse domains in alteration.

13805 **(N—86-31729) Correlation of processing and sintering variables with the strength and radiography of silicon nitride.** Sanders, W.A.; Baaklini, G.Y. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 37p. (NASA-TM—87251; E—2934; NAS—1.15:87251; CONF-860152—9). NTIS HC A03/MF A01.

From 10. annual conference on composites and advanced ceramic materials; Cocoa Beach, FL, USA (19 Jan 1986).

A sintered Si_3N_4-SiO2-Y_2O_3 composition, NASA 6Y, was developed that reached four-point flexural average strength/standard deviation values of 857/36, 544/33, and 462/59 MPa at room temperature, 1200 and 1370 C respectively. These strengths represented improvements of 56, 38, and 21 percent over baseline properties at the three test temperatures. At room temperature the standard deviation was reduced by over a factor of three. These accomplishments were realized by the iterative utilization of conventional x-radiography to characterize structural (density) uniformity as affected by systematic changes in powder processing and sintering parameters. Accompanying the improvement in mechanical properties was a change in the type of flaw causing failure from a pore to a large columnar beta- Si_3N_4 grain typically 40 to 80 microns long, 10 to 30 microns wide, and with an aspect ratio of 5:1.

13806 **(N—86-31913) Quantitative void characterization in structural ceramics using scanning laser acoustic microscopy.** Roth, D.J.; Generazio, E.R.; Baaklini, G.Y. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 23p. (NASA-TM—88797; E—3166; NAS—1.15:88797; CONF-861107—1). NTIS HC A02/MF A01.

From Meeting on ceramics: basic science and electronics; New Orleans, LA, USA (2 Nov 1986).

The ability of scanning laser acoustic microscopy (SLAM) to characterize artificially seeded voids in sintered silicon nitride structural ceramic specimens was investigated. Using trigonometric relationships and Airy's diffraction theory, predictions of internal void depth and size were obtained from acoustic diffraction patterns produced by the voids. Agreement was observed between actual and predicted void depths. However, predicted void diameters were generally much greater than actual diameters. Precise diameter predictions are difficult to obtain due to measurement uncertainty and the limitations of 100 MHz SLAM applied to typical ceramic specimens.

13807 **(N—87-11009) Processing of laser formed SiC powder. Final Report, 30 July 1982-31 December 1985.** Haggerty, J.S.; Bowen, H.K. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1985. 85p. (NASA-CR—179857; NAS—1.26:179857). NTIS, PC A05/MF A01.

Superior SiC characteristics can be achieved through the use of ideal constituent powders and careful post-synthesis processing steps. High purity SiC powders of approx. 1000 A uniform diameter, nonagglomerated and spherical were produced. This required major revision of the particle formation and growth model from one based on classical nucleation and growth to one based on collision and coalescence of Si particles followed by their carburization. Dispersions based on pure organic solvents as well as steric stabilization were investigated. Although stable dispersions were formed by both, subsequent part fabrication emphasized the pure solvents since fewer problems with drying and residuals of the high purity particles were anticipated. Test parts were made by the colloidal pressing technique; both liquid filtration and consolidation (rearrangement) stages were modeled. Green densities corresponding to a random close packed structure (approx. 63%) were achieved; this highly perfect structure has a high, uniform coordination number (greater than 11) approaching the quality of an ordered structure without introducing domain boundary effects. After drying, parts were densified at temperatures ranging from 1800 to 2100 C. Optimum densification temperatures will probably be in the 1900 to 2000 C range based on these preliminary results which showed that 2050 C samples had experienced substantial grain growth. Although overfired, the 2050 C samples exhibited excellent mechanical properties. Biaxial tensile strengths up to 714 MPa and Vickers hardness values of 2430 kg/sq mm 2 were both more typical of hot pressed than sintered SiC. Both result from the absence of large defects and the confinement of residual porosity (less than 2.5%) to small diameter, uniformly distributed pores.

13808 **(PB—87-102794/XAB) Dispersion strengthened cemented carbides.** Cutler, R.A.; Alexander, G.B.; Plichta, M.R. (Terra Tek, Inc., Salt Lake City, UT (USA)). Sep 1983. 45p. (TRE—83-07). NTIS, PC A03/MF A01.

The research studied the feasibility of strengthening WC-CO cermets by adding refractory oxides to the binder phase. Cemented carbides containing 0.06 to 1.5 vol. % finely dispersed oxide particles in cobalt powder, prior to liquid phase sintering, were densified and compared to undoped control powders. Three different processes for dispersing refractory oxides in cobalt metal were investigated. Results suggest that the oxide particles coalesced and/or segregated to WC-CO interfaces during the liquid-phase sintering process.

13809 **Effect of impurities on SiC whisker morphology.** Mazdiyasni, K.S.; Zangvil, A. (Air Force Wright Aeronautical Labs., Wright-Patterson Air Force Base, OH). *Journal of the American Ceramic Society;* **68**: No. 6, C.142-C.144(Jun 1985). Contract AC02-76ER01198.

Thermal decomposition of polymeric organosilicon, as precursor to SiC whiskers, in the presence of impurities such as alkali and alkaline-earth metals and aluminum related in glass beads or droplets on the β-SiC whiskers. Semiquantitative analysis of typical whiskers and whiskers with glass beads were performed using a transmission electron microscope equipped with an energy-dispersive X-ray spectrometer and a scanning transmission electron microscope equipped with an electron energy loss spectrometer. The major impurities identified were correlated with the processing method employed. 7 references, 6 figures, 1 table.

3606 Other Materials

REFER ALSO TO CITATION(S) 13294, 13365, 13365, 13560, 13790, 13898, 15130, 15131, 15263

13810 **(AD-A—172942/5/XAB) Investigation of ion implantation into high-purity and controllably doped silicon and into gallium arsenide. Final report, January 1982-February 1983.** Carter, G. (Salford Univ. (UK). Dept. of Electrical Engineering). 21 Feb 1983. 61p. NTIS, PC A04/MF A01.

Data derived from the use of Rutherford backscattering-channelling measurements of disorder production in ion implanted semiconductors for the determination of damage-production mechanisms were analyzed. The redistribution and lattice incorporation of implanted impurities in Si during controlled furnace annealing to reorder the implantation damaged Si were studied. Production of disorder in InP by light- and heavy-ion implantation was investigated as function of implant flux and fluence and implant temperature. Investigation, in parallel with (3) of the damage creation and annealing processes associated with the interaction of the RBS/channeling analysis ion probe with heavy-ion implantation damage in InP is discussed.

13811 **(AD-A—174334/3/XAB) Minority-carrier investigations of beam-annealed and thermally-annealed semiconductors. Final report, October 1981-October 1985.** Merz, J.L. (California Univ., Santa Barbara (USA)). Sep 1986. 57p. NTIS, PC A04/MF A01.

The effect of beam-processing on III-IV compound semiconductors, particularly indium phosphide(InP), was investigated in detail. Two types of beams were used to anneal ion-implantation damage in these materials, scanned CW Argon ion laser beams, and incoherent radiation focused on the sample. Two different but related problems were addressed. (1) The problem of accurately measuring the equilbrium temperature of the sample in the region that is heated by a focused CW laser beam has been studied using novel techniques: in-situ high-temperature photoluminescence and Raman-scattering measurement. Accurate temperature measurements for this case were obtained for the first time; far less spatial dependence of the thermal profiles was observed than is predicted by existing theories, which neglect important effects such as carrier diffusion. (2) Rapid thermal annealing of ion-implanted InP was studied for a variety of implant and anneal conditions using low-temperature photoluminescence, Raman scattering, and Rutherford backscattering. The results of all three of these characterization techniques were self-consistent, and showed that, in order to obtain single-crystal material with high electrical activation, it is necessary to perform the implants at an elevated temperature (approx. 200 C) and to anneal at as high a temperature as possible without causing significant dissociation.

13812 **(BDX—613-3642) Screening testing for composite prepregs: Final report.** Carey, D.A. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Jan 1987. Contract AC04-76DP00613. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004557.

Differential scanning calorimetry (DSC), Rheometrics mechanical spectrometry (RMS), dielectric spectrometry (DS) and high pressure liquid chromatography (HPLC) were used to determine the level of advancement of a high-performance, carbon-fiber-reinforced epoxy composite. The experimental results indicated that the RMS, HPLC and DS methods can be used to assess the degree of advancement. DSC can be used to distinguish between as received prepreg and aged prepreg; however, from the DSC data, it is difficult to determine the degree of advancement. Acceptable parts were fabricated from preforms aged at -31°C over 397 days. Parts produced from compression molded preforms that were aged for longer than 19 days at room temperature under low or high humidities failed the thickness specification for production parts.

13813 **(CEA-CONF—8448) Glass stability under irradiation.** Biron, I. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1986. 3p. (In French). (CONF-8604271—1-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750708.

From Meeting on order-disorder and point effects; Grenoble, France (15 Apr 1986).

Published in summary form only.

13814 **(CONF-861002—5) Development of alumina- and mullite-SiC whisker composites: High temperature properties.** Tiegs, T.N.; Becher, P.F. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02. File Number DE87004624.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (27 Oct 1986).

The development of SiC whisker-reinforced ceramic composites is proceeding. At the present time, substantial fracture toughness and strength improvements for alumina and mullite matrix composites have been demonstrated. Equally important is that these properties are retained to temperatures of at least 1000°C. In addition, the alumina-SiC whisker composites have been shown to have excellent resistance to static fatigue at temperatures up to 1100°C. Degradation of the mechanical properties by oxidation is a potential problem for high-temperature structural applications. However, with the use of high purity matrices degradation can be minimized.

13815 **(CONF-861207—38) Investigations of low-temperature epitaxy, ion damage, and reactive-ion cleaning utilizing ion beam deposition.** Appleton, B.R.; Zuhr, R.A.; Noggle, T.S.; Herbots, N.; Pennycook, S.J. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004398.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

The technique of ion beam deposition (IBD) is utilized to investigate low-energy, ion-induced damage on Si and Ge; to study reactive ion cleaning of Si and Ge; to fabricate amorphous isotopic heterostructures; and to fabricate and study the low-temperature epitaxial deposition of ^{74}Ge on Ge(100), ^{30}Si on Si(100), and ^{74}Ge on Si(100). The techniques of ion scattering/channeling and cross-sectional TEM are combined to characterize the deposits.

13816 **(CONF-870306—4) Laboratory performance testing of an extruded bitumen containing a surrogate, sodium nitrate-based, low-level aqueous waste.** Mattus, A.J.; Kaczmarsky, M.M. (Oak Ridge National Lab., TN (USA); WasteChem Corp., Paramus, NJ (USA)). 15 Dec 1986. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004272.

From Waste management '87; Tucson, AZ, USA (1 Mar 1987).

Laboratory results of a comprehensive, regulatory performance test program, utilizing an extruded bitumen and a surrogate, sodium nitrate-based waste, have been compiled at the Oak Ridge National Laboratory (ORNL). Using a 53 millimeter, Werner & Pfleiderer extruder, operated by personnel of WasteChem Corporation of Paramus, New Jersey, laboratory-scale, molded samples of type three, air blown bitumen were prepared for laboratory performance testing. A surrogate, low-level, mixed liquid waste, formulated to represent an actual on-site waste at ORNL, containing about 30 wt % sodium nitrate, in addition to eight heavy metals, cold cesium and strontium was utilized. Samples tested contained three levels of waste loading: that is, forty, fifty and sixty wt % salt. Performance test results include the ninety day ANS 16.1 leach test, with leach indices reported for all cations and anions, in addition to the EP Toxicity test, at all levels of waste loading. Additionally, test results presented also include the unconfined com-

pressive strength and surface morphology utilizing scanning electron microscopy. Data presented include correlations between waste form loading and test results, in addition to their relationship to regulatory performance requirements.

13817 **(DOE/ER/45161—2) Low stress brittle fracture in polymers: Progress report as of October 23, 1986.** Brown, N. (Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science). 1986. Contract FG02-84ER45161. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004297.

Slow crack growth was studied in linear polyethylene (PE) and an ethylene-hexene copolymer. The relation of molecular weight of PE to initial damage rate prior to slow crack growth was studied. (DLC)

13818 **(DOE/ER/45210—T1) The formation of ordered microstructures by slip casting and related processes: Progress report.** Russel, W.B. (Princeton Univ., NJ (USA). Dept. of Chemical Engineering). Dec 1986. Contract FG02-85ER45210. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004135.

Experiments to test the predictions of theory will employ silica particles made by the Stober method and coated with stearyl alcohol to form nearly hard spheres when suspended in cyclohexane-chloroform solvents. A computerized simulation study is also being conducted.

13819 **(DP-MS—86-72) Large scale leach testing of DWPF canister sections.** Bickford, D.F.; Pellarin, D.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 10p. (CONF-861207—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004182.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A Large-Scale Leach Test Facility (LSLTF) has been constructed at the US Department of Energy's Savannah River Laboratory (SRL) to perform static leach tests on 24-inch (610 mm)-diameter canister sections cut from simulated (nonradioactive) waste forms cast under reference conditions. The equipment and test procedures are designed to closely correspond to MCC-1 leach test criteria. Less than a factor of 3 increase in leachability results from combined scale-up, glass-cracking, leached surface area estimation, and surface roughness effects. This factor is dominated by surface roughness of saw cut surfaces. The factor is negligible when compared to the 200,000/l ratio of glass sample masses. The MCC-1, and other small-scale leach tests have been valuable in determining the relative merits of alternative waste form compositions. However, the actual waste glass to be stored in repositories is subject to fracture, devitrifiction, and container/glass interactions, which are difficult to simulate on a laboratory scale. Large-scale leach tests integrate these and other possible waste form characteristics that are not represented in typical small samples. The facility, equipment, test method and results of one-year leach testing are discussed. These results substantiate the applicability of small scale test data which precede this work, and the use of small scale tests to simulate leaching of the Defense Waste Processing Facility's borosilicate glass product. Exceptionally good sampling statistics make the large scale data particularly well suited for verification of models of leachability rates.

13820 **(EGG-M—32786) Studies of stress wave propagation in composites.** Epstein, J.S.; Deason, V.A.; Abdallah, M. (EG and G Idaho, Inc., Idaho Falls (USA); Hercules, Inc., Magna, UT (USA). Bacchus Works). 1986. Contract AC07-76ID01570. 6p. (CONF-8611110—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001433.

From SEM fall meeting; Keystone, CO, USA (2 Nov 1986).

Recent phenomenological developments in the use of dynamic moire interferometry for the study of transient wave propagation on the free surface of graphite/epoxy composites are discussed. The technique of dynamic moire interferometry is briefly outlined. Experimental results are discussed in light of developed continuum theories for the propagation of transient waves in laminated anisotropic media. The emphasis of the discussion is on observed waveguide effects in laminated media.

13821 **(EPRI-EL—4939) Literature review of pyrolysis and combustion products of selected utility materials: Interim report.** Carson, B.L.; Erickson, M.D.; McCann, J.L. (Midwest Research Inst., Kansas City, MO (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 182p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920165.

This information on the thermal-combustion products of utility fabrication and construction materials can help utilities evaluate potential hazards of equipment and materials in fire situations. Grouped by chemical composition, the more toxic degradation products are summarized in the report. However, relative abundance in the utility environment is not taken into account.

13822 (ESA-SP—38, pp vp) **Debonding analysis of thermally stressed fiber-reinforced composite materials.** Buchholz, F.G.; Senger, K.H. Apr 1986. NTIS, PC A19/MF A01. (ETN—86-98078; CONF-8512111—).

From International conference on spacecraft structures; Toulouse, France (3 Dec 1985).

The effects of two ways of micromechanical modeling on the debonding analysis of thermally stressed unidirectionally fiber-reinforced composite materials are investigated. The models are a simple single circular unit cell and a more complex hexagonal unit cell embedded in the surrounding compound, as different orders of approximation to a real composite material. Correlation between the thermally induced elastic strain energy and the energy release rate of a curved interface crack, debonding an individual fiber from the adherent matrix material in both models is studied. The influence of increasing fiber volume fractions on the debonding behavior is assessed. Results show that the elastic strain energies induced in the models nearly coincide, although they differ distinctly in their geometrical contours and boundary conditions. For fiber volume fractions 10% it is shown that only the more complex model can deliver relevant results for the thermally induced plane strain debonding process in a real material.

13823 (ESA-SP—38, pp vp) **Performance characteristics of composite materials.** Bergmann, H.W.; Gaedke, M.; Goetting, H.C. Apr 1986. NTIS, PC A19/MF A01. (ETN—86-98078; CONF-8512111—).

From International conference on spacecraft structures; Toulouse, France (3 Dec 1985).

Allowable stresses for multidirectional laminates with arbitrary stacking orders are predicted analytically using the characteristics of unidirectional plies established by test. The forecast properties for static tension loading include first ply failure and ultimate strength and take into account the state of prestress induced by widely varying environmental conditions. In laminates mechanically fatigued at R = 0.1 the influences of temperature and moisture are shown to be moderate. In matrix-controlled laminates, elevated temperature and moisture saturation degrade the fatigue strength, while in fiber-controlled laminates the presence of moisture tends to be beneficial. In multidirectional laminates the slopes of the delta-N curves are essentially unaffected in various hot-wet conditions. Matrix-controlled laminates subjected to severe thermal cycling exhibit strength and stiffness degradations depending on the brittleness of the matrix systems. Moderate to severe matrix cracking is observed.

13824 (ESA-SP—38, pp vp) **Method of studying the behavior of composite materials in simulated space environments.** Albugues, F.; Plotard, P.; Gomez, M.F.; Paillous, A.; Judd, M.D. (Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France; European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands). Apr 1986. (In French). NTIS, PC A19/MF A01. (ETN—86-98078; CONF-8512111—).

From International conference on spacecraft structures; Toulouse, France (3 Dec 1985).

A method to evaluate the mechanical properties of composite spacecraft structural materials in simulated space vacuum, radiation, and thermal conditions was developed. It can irradiate in secondary vacuum a test batch of which a part is measured in situ and the rest afterwards. Different stages of aging due to UV and electron irradiation can be accounted for.

13825 **(EUR—9691) Study of selective glasses produced by the Pyrosol process.** Blandenet, G.; Lagarde, Y.; Court, M.; Chazee, J.J. (Commission of the European Communities, Luxembourg). 1985. 112p. (In French). Commission of the European Communities, Luxembourg.

To lower the cost of selective glasses produced in the conveyor-system coating process by the Pyrosol technique, technical and economic improvements were investigated. As far as the improvement in the properties of tin oxide is concerned, it is necessary first to deposit a protective coating on the glass to prevent the products generated from the pyrolysis of stannic chloride from reaching the substrate and reacting with the alkalines it contains. The solutions envisaged have not led to positive results, although some other coatings have proved more satisfactory. The development of an apparatus to control the aerosol has endowed the conveyor-system Pyrosol equipment with a means of instantaneous control over aerosol production. This enables variations of less than 5% in aerosol output to be detected. In addition, the uniformity and reproducibility of deposits after stopping and restarting the machine are improved. On the other hand, it is possible to obtain a reduction in costs of indium oxide coatings by optimizing the preparation of the indium acetylacetonate and by reprocessing indium-based products.

13826 (INIS-SU—392, pp 569) **Effect radiation treatment by γ-radiation on Pb(N/sub 3/)/sub 2/ stability to laser radiation.** Aleksandrov, E.I.; Bondarenko, A.L.; Tsipilev, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13827 **(LBL—22652) Hydrogen-related acceptor complexes in germanium.** Kahn, J.M. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 329p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE87004471.

One or more atoms of hydrogen can combine with other elements, to form shallow acceptor complexes in semiconductors. The acceptor states of several hydrogen-related complexes in germanium have been studied by means of photothermal ionization spectroscopy.

13828 **(N—87-10765) Total-dose radiation effects data for semiconductor devices. 1985 Supplement. Volume 2, part B.** Martin, K.E.; Gauthier, M.K.; Coss, J.R.; Dantas, A.R.V.; Price, W.E. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1986. 421p. (NASA-CR—179741; JPL-PUB—85-43-VOL-2-PT-B; NAS—1.26:179741). NTIS, PC A18/MF A01.

Steady-state, total-dose radiation test data are provided in graphic format, for use by electronic designers and other personnel using semiconductor devices in a radiation environment. The data were generated by JPL for various NASA space programs. The document is in two volumes: Volume 1 provides data on diodes, bipolar transistors, field effect transistors, and miscellaneous semiconductor types, and Volume 2 (Parts A and B) provides data on integrated circuits. The data are presented in graphic, tabular, and/or narrative format, depending on the complexity of the integrated circuit. Most tests were done steady-state 2.5-MeV electron beam. However, some radiation exposures were made with a cobalt-60 gamma ray source, the results of which should be regarded as only an approximate measure of the radiation damage that would be incurred by an equivalent electron dose. All data were generated in support of NASA space programs by the JPL Radiation Effects and Testing Group (514).

13829 **(N—87-10977) Effects of space radiation on a chemically modified graphite-epoxy composite material. Interim report.** Reed, S.M.; Herakovich, C.T.; Sykes, G.F. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Oct 1986. 97p. (NASA-TM—89232; NAS—1.15:89232; CCMS—86-06; VPI-E—86-19; IR—60). NTIS, PC A05/MF A01.

The effects of the space environment on the engineering properties and chemistry of a chemically modified T300/934 graphite-epoxy composite system are characterized. The material was subjected to 1.0 x 10 to the 10th power rads of 1.0 MeV electron irradiation under vacuum to simulate 30 years in geosynchronous earth orbit. Monotonic tension tests were performed at room temperature (75 F/24 C) and elevated temperature (250 F/121 C) on 4-ply unidirectional laminates. From these tests, inplane engineering and strength properties (E sub 1, E_2, Nu_{12}, G_{12}, X/sub T/, Y/sub T/) were determined. Cyclic tests were also performed to characterize energy dissipation changes due to irradiation and elevated temperature. Large diameter graphite fibers were tested to determine the effects of radiation on their stiffness and strength. No significant changes were observed. Dynamic-mechanical analysis demonstrated that the glass transition temperature was reduced by 50 F(28 C) after irradiation. Thermomechanical analysis showed the occurrence of volatile products generated upon heating of the irradiated material. The chemical modification of the epoxy did not aid in producing a material which was more radiation resistant than the standard T300/934 graphite-epoxy system. Irradiation was found to cause crosslinking and chain scission in the polymer. The latter produced low molecular weight products which plasticize the material at elevated temperatures and cause apparent material stiffening at low stresses at room temperature.

13830 **(PNL-SA—13797) Solubility interpretation of leach tests.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1986. Contract AC06-76RL01830. 14p. (CONF-860905—27). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004497.

From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, NY, USA (14 Sep 1986).

The phenomenological behavior of commercial silicate glasses and nuclear borosilicate glasses in confined glass:aqueous solution systems is similar. For commercial silicate glasses the behavior has been described, "If the neutral solution is unbuffered and confined in a bottle, it becomes alkaline and attack is accelerated, but eventually the accumulated products inhibit further action." Similar behavior is observed for nuclear waste borosilicate waste glasses in the MCC-1 Static Leach Test Method, the pulsed-flow test, and other leach tests in which the amount of solution in contact with the glass is restricted. In these tests the concentration of ions in the leachate increases initially (but not congruently, that is, the ratio of ion concentrations in the leachate is different than in the original glass), however, the concentration of each ion tends gradually towards its own steady-state concentration. The "accumulated products" that "inhibit further action", and result in the tendency toward steady-state leachate concentrations, are found in an altered layer on the surface of the leached glass and are generally considered to arise from solubility constraints. 21 refs., 2 figs., 2 tabs.

13831 **(PNL-SA—14364) Particle and fiber production of polymeric materials during the rapid expansion of supercritical fluid solutions.** Matson, D.W.; Petersen, R.C.; Smith, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1986. Contract AC06-76RL01830. 7p. (CONF-8606202—5). NTIS, PC A02/MF A01. File Number DE87004464.

From CRDEC conference on obscuration and aerosol research; Aberdeen, MD, USA (23 Jun 1986).

Solute nucleation and condensation processes leading to the formation of powders and fibers during the rapid expansion of supercritical fluid solutions are discussed. Examples of polymeric powders and fibers produced during the initial investigations of this process as a method for materials preparation are presented. Future work in this area will involve investigation of additional solvent-solute system and theoretical modeling of the particle formation mechanism operating during the expansion process.

13832 **(SAND—86-1409C) Effectiveness of thin film encapsulants for reducing evaporation during rapid thermal processing of GaAs.** Haynes, T.E.; Picraux, S.T.; Chu, W.K. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy; Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 7p. (CONF-861207—37). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003513.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A technique is described for direct measurement of evaporation of Ga and As from capped GaAs during rapid thermal processing (RTP). Application of this method to the study of Si, SiO_2, and Si_3N_4 caps with thicknesses of 20 nm to 60 nm provides a direct measure of the temperature ranges for which the caps are able to prevent evaporation during RTP. In addition, kinetic studies of the evaporation at slightly higher temperatures provides information useful for establishing the predominant evaporation mechanism. For the encapsulants studied, these measurements indicate that the observed evaporation is due to formation of cracks in the film during the initial 10 s of RTP.

13833 **(SAND—86-1821C) Stress release in ion implanted lattice mismatched semiconductor heterostructures.** Arnold, G.W.; Picraux, S.T.; Myers, D.R.; Doyle, B.L.; Peercy, P.S.; Biefeld, R.M.; Dawson, L.R. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 6p. (CONF-861207—41). NTIS, PC A02/MF A01. File Number DE87004518.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Cantilever-beam measurements of ion-implantation induced stress in (InGa)As/GaAs, Ga(AsP)/GaP, and Ga(AsP)/GaAs strained layer superlattices (SLSs), grown either by molecular-beam epitaxy (MBE) or metalorganic chemical vapor deposition (MOCVD), have shown that a mechanism for precipitous stress-relief can be operative for room-temperature damage-energy deposition values above $\sim 2 \times 10^{20}$ keV/cm^3. This phenomenon is correlated with the initial residual compressive stress on the composite structure and is determined by the differences in lattice parameter between the substrate and the buffer alloy-layer.

13834 **(SAND—86-2800C) Transition-state model for entropy-limited freezing.** Tsao, J.Y.; Aziz, M.J.; Peercy, P.S.; Thompson, M.O. (Sandia National Labs., Albuquerque, NM (USA); Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences; Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science). 1986. Contract AC04-76DP00789. 8p. (CONF-861207—35). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003512.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A brief review is given of transition-state theory, both for the case of unimolecular reactions in the gas phase, and for reactions in condensed phases. An argument is made, within the context of this theory, that freezing in Si is limited to rates much lower than collision rates by the difference between the entropies of the solid and the liquid.

13835 **(UCRL—94658) Integrated testing of the SRL-165 glass waste form.** Phinney, D.L.; Ryerson, F.J.; Oversby, V.M.; Lanford, W.A.; Aines, R.D.; Bates, J.K. (Lawrence Livermore National Lab., CA (USA); State Univ. of New York, Albany (USA); Argonne National Lab., IL (USA)). Dec 1986. Contract W-7405-ENG-48. 15p. (CONF-861207—33). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004358.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Integrated testing of the important components of a glass waste form waste package has been performed in order to gain a better understanding of the processes of radionuclide release and transport in the near field environment. Based upon an interpretation of the depth of penetration of hydrogen in reacted SRL-165 glass we have modeled the radionuclide release from the glass as a combined process of (1) the diffusive exchange of alkalis and boron in the glass for hydrogen species in the solution ($D = 10^{-16}$ cm^2/s) and (2) surface dissolution. Surface dissolution controls the release of components not exchanged by diffusion and takes place at a rate of 1.5 to 3.0 μm/yr. Subsequent to release the radionuclides may remain in the leach solution, diffuse into the tuff, or precipitate as secondary phases. Precipitation is particularly important for plutonium and americium. Diffusive transport of radionuclides through the tuff takes place at an extremely slow rate, $D = 10^{-16}$ cm^2/s. As such, the mass of radionuclides incorporated in the tuff by diffusion during the tests is inconsequential relative to that in the leach solution (with the exception of plutonium) and can be ignored in mass balance calculations. Mass balance calculations based upon the release of radionuclides by surface dissolution of the glass waste form are in good agreement with observed solution chemistry when allowances are made for a pulse of dissolution early in the tests. This pulse may be due to either the rapid dissolution of high-energy surface features early in the integrated tests, or an initially high surface dissolution rate that decreases with time as silica saturation is approached, or a combination of the two.

13836 **Superconductivity and magnetic interactions in Yb /SUB 1.2-x/ Eu /SUB x/ Mo_6S_8 pseudoternary Compounds.** Torikachvili, M.S.; Beille, J.; Lambert, S.E.; Maple, M.B. (Lab. Louis Neel, CNRS-USMG, Grenoble). *Journal of Low Temperature Physics;* **65**: No. 5/6, 389-397(Dec 1986).

The superconducting and magnetic properties of the Yb / SUB 1.2-x/ Eu /SUB x/ Mo_6S_8 series of compounds have been investigated by means of ac magnetic susceptibility, electrical resistivity, and upper critical magnetic field H /SUB c2/ measurements. The superconducting transition temperature at ambient pressure is depressed by Eu additions, until superconductivity disappears completely at x about0.7. For Eu concentrations $x<0.45$, H /SUB c2/ is enhanced at low temperatures and exceeds the values for pure Yb /SUB 1.2/ Mo_6S_8. The temperature dependence of H /SUB c2/ for the various Yb /SUB 1.2-x/ Eu /SUB x/ Mo_6S_8 compounds is analyzed using a multiple pair-breaking theory that includes the compensation of the applied magnetic field by the negative exchange field produced by antiferromagnetic interactions between the conduction electron spins and the Eu^{2+} spins (Jaccarino-Peter effect). Hydrostatic pressure was found to induce superconductivity in all Eu-rich compositions that were not superconducting at ambient pressure.

13837 **(ESA-TT—50) Material selection for carbon fiber reinforced composite structures.** (European Space Agency, 75 - Paris (France)). Jan 1986. Translation of Werkstoffauswahl fuer Verbundstrukturen aus CFK Report DFVLR-Mitt-85-09, 188(Jun 1985). (DFVLR-MITT—85-09; ETN—86-98242; CONF-8506330—). 174p. NTIS, PC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50.

From Colloquium on structural mechanics; Brunswick, F.R. Germany (19 Jun 1985).

Composite structures for light constructions; infuence of environmental conditions on carbon fiber reinforced plastics; carbon fiber reinforced plastic strength, and reaction to humidity and temperature; resin selection for application of specific carbon fiber types; fiber resin interface (chemical analysis); and the influence of various parameters on the microscopic fractograph of carbon fiber tensile test specimens were discussed.

13838 **(ESA-TT—50, pp vp) Environmental influences on CFRP.** Niederstadt, G. Jan 1986. Translation of Werkstoffauswahl fuer Verbundstrukturen aus CKF Report DFVL-Mitt-85-09, vp(Jun 1985). NTIS, PC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50.

From Colloquium on structural mechanics; Brunswick, F.R. Germany (19 Jun 1985).

In Material selection for carbon fiber reinforced composite structures.

Responses of fiber and resin matrix in carbon fiber reinforced fibers to humidity, temperature, and solar radiation were studied. Responses to humidity include loss of mechanical properties (fracture strength and elasticity, deformability of the plastics) plus matrix swelling. Increased fracture strain leads to improved ductility of specific resin matrix systems. Responses to temperature rise include increased fracture strain, reduced strength and stiffness for plastics, and matrix thermal expansion. Responses to solar radiation include reduced molecular weight and mechanical strength, stress corrosion cracking for plastics, and matrix aging swelling. Coating of the carbon fiber structure surface with glass fibers or pure resin matrix systems is recommended to avoid strain corrosion due to the glass fiber laminate response to radiation.

13839 (ESA-TT—50, pp vp) **Influence of various parameters on the microscopic fracture pattern of tensile test specimens of CFRP.** Nitsch, P. Jan 1986. Translation of Werkstoffauswahl fuer Verbundstrukturen aus CFK Report DFVLR-Mitt-85-09, vp(Jun 1985). NTIS, PC A08/MF A01; original German version available from DFVLR, Cologne, West Germany DM 50.

From Colloquium on structural mechanics; Brunswick, F.R. Germany (19 Jun 1985).

In Material selection for carbon fiber reinforced composite structures.

The effects of water intake in the matrix, hardening and thermal cycling, temperature rise during loading, and increased resin ductility on the microscopic fractograph of carbon fiber reinforced plastics and pure epoxy resin under tension load were investigated regarding individual fiber fracture, adhesion failure, and microcrack formation in the matrix using a scanning electron microscope. Fiber/resin adhesion depends on the temperature and humidity content. Quantification of the fiber/resin adhesion with the mean fiber extension length shows a correlation with the residual tensile strength.

13840 **Thin (50-100nm) WO/sub 3/ films for practical energy-conserving electrochromic windows.** Goldner, R.B.; Wong, K.; Foley, G.; Norton, P.; Wamboldt, L.; Seward, G.; Haas, T.; Chapman, R. (Electro-Optics Technology Center, Tufts Univ., Medford, MA 02155). pp 433-434 of Proceedings of the 1986 Spring meeting of the Electrochemical Society. Pennington, NJ; The Electrochemical Society (1986). (CONF-860540—).

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

On the basis of experimental results, the authors conclude that, currently, one can fabricate thin (50-100nm) films of WO/sub 3/ which will have spectrally-selective transmittance modulation properties, useful for fabricating practical electrochromic windows and that since the higher than desired ΔA and lower than desired ΔR is probably caused by excess free electron scattering arising from extended defects (structural disorder), it should be possible to achieve the ΔR and ΔA predicted by SG by using appropriate but, as yet, unknown film deposition techniques.

13841 **Neutron diffraction study of the bonding of zeolitic water in scolecite at 20 K.** Kvick, A.; Stahl, K.; Smith, J.V. (Brookhaven National Lab., Upton, NY, USA. Dept. of Chemistry; Chicago Univ., IL, USA. Dept. of Geophysical Sciences). *Zeitschrift fuer Kristallographie, Kristallgeometrie, Kristallphysik, Kristallchemie;* **171**: No. 1/2, 141-154(1985).

There is no indication of substitutional disorder in the structure. The Ca atoms coordinate four framework oxygens and three water oxygens in a distorted pentagonal bipyramid. The hydrogen bonds to the framework oxygens vary in length and linearity. The O-H distances in water fall in the range 0.979-0.993 A, and the water angles H-O-H are 106.7(1)/sup 0/, 107.3(2)/sup 0/ and 111.1(1)/sup 0/. A neutron scattering length for Ca of 0.465(3) x 10/sup -14/ m is suggested.

13842 **High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon.** Pennycook, S.J.; Narayan, J.; Culbertson, R.J.; Fogarassy, E. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **41**: 287-294(1985). Contract AC05-84OR21400.

Two new electron microscopy techniques have been developed which greatly extend the capabilities for the micro-characterization of semiconductors. The first is a technique for the direct imaging of dopants in semiconductors, whether or not they are in solution, using Z-contrast, and the second is a technique for determining the substantial fraction of dopant. Both techniques are capable of nanometer spatial resolution and allow the detailed study of dopant segregation, precipitation, and clustering effects. 8 references, 8 figures.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 13031, 13066, 13073, 13187, 13188, 13312, 13456, 13898

13843 **(BNL—39076) Anomalous dispersion corrections to surface and interface EXAFS measurements made using glancing angles.** Chen, H.; Heald, S.M.; Tranquada, J.M. (Brookhaven National Lab., Upton, NY (USA)). 1 Dec 1986. Contract AC02-76CH00016;AS05-80ER10742. 5p. (CONF-861207—25). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004170.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Extended x-ray absorption fine structure studies using glancing angle fluorescence on the interface of the Cu-Al thin film system show that the sputtering process generates a different interface structure than for an evaporated one. To obtain quantitative information, the anomalous dispersion effects have to be considered. Simple model calculations are presented for the correction factor which yield good results for Au thin film data. Extension of this model to bilayer systems is discussed. 7 refs., 4 figs., 1 tab.

13844 **(DOE/PC/70799—T8) Identification of nonvolatile coal derived products via chromatography coupled with on-line FTIR detection: Quarterly progress report for the period June 1, 1986-August 31, 1986.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jan 1987. Contract FG22-84PC70799. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003934.

The analysis of nonvolatile coal-derived liquefaction products for minor and trace components which contain nitrogen, oxygen or sulfur presents unique challenges. Justification for their analysis rests on the premise that heteroatom-containing materials can aid and/or hinder the conversion process. This proposal builds upon our efforts during the initial three year grant period regarding the interfacing of Fourier transform infrared spectrometry with size exclusion and normal phase chromatography for the analysis of coal-derived products. Four objectives are proposed: (1) optimize the HPLC-FTIR interface in terms of detectability, identifiability and chromatography, (2) extend the HPLC-FTIR approach to reversed phase chromatography wherein more efficient separations are possible for heteroatom species, (3) determine the feasibility of interfacing supercritical fluid chromatography with FTIR for the analysis of coal-derived products and (4) employ hyphenated methods to ascertain on a molecular level the changes that occur in a nonvolatile coal derived product when various liquefaction parameters are varied. This quarterly report describes the separation of several metal-containing systems using supercritical fluid chromatography. Packed, analytical scale chromatographic columns have been employed using supercritical methanol modified CO_2 as the mobile phase. 20 refs., 9 figs.

13845 **(ENEA-RT-TIB—86/6) Analysis of surface saline waters: 1, Iodometric determination of the oxygen dissolved in sea water.** Castagnola, A.M. (ENEA, Casaccia (Italy). Dipartimento Tecnologie Intersettorialli di Base). 1986. 28p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. File Number DE87900400.

In the frame of an analytical manual intended for the examination of surface saline waters, a discussion is given of the iodometric methods for determining oxygen dissolved in sea water and brackish water. The principal modifications of the original Winkler method are compared in order to select a procedure that applies to conditions generally occurring in aquaculture. Difficulties dealing with correct sampling and storage are briefly reviewed together with possible sources of systematic errors. Two equipments for the production of synthetic sea water for use as a reference water in the calibration of oxygen amperometric probes are presented.

13846 **(GKSS—86/E/37) Determination of methane in water by absorption spectroscopy.** Balssen, G. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 1986. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87751175.

Several laser spectroscopic techniques for the determination of dissolved aliphatic hydrocarbons have been investigated. Best sensitivity is achieved if the dissolved substances are in the gaseous phase. Therefore different extraction methods have also been studied. Helium stripping with direct optical absorption in a two-mirror multipass cell turned out to be most favourable combination. The results are discussed in view of underwater pipeline leak detection, petroleum exploration, and other applications. With 38 figs., 10 tabs.

13847 (INIS-mf—10100, pp 26) **Determination of beta-emitting impurities in radioactive certified reference materials to be used at nuclear facilities.** Barta, T.; Lueff, S.; Szoerenyi, A. (National Office of Measures, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13848 (INIS-mf—10100, pp 37) **New option of SAMPO80/a minicomputer program for gamma spectrum analysis/for detection limit calculations.** Zombori, P.; Steger, F. (Hungarian Academy of Sciences, Budapest; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

13849 (INIS-SU—392, pp 535) **Determination of nitrogen content in biological objects using deuteron activation method.** Melenevskij, A.Eh.; Lyubinskij, N.N.; Nemykin, V.I.; Tikhij, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13850 **(PB—87-108544/XAB) Uranium-235 isotope-abundance standard reference materials for gamma-spectrometry measurements. Final report.** Carpenter, B.S.; Gramlich, J.W.; Greenberg, R.R.; Machlan, L.A.; DeBievre, P. (National Bureau of Standards, Washington, DC (USA). Center for Analytical Chemistry). Sep 1986. 101p. (NBS/SP—260/96). NTIS, PC A06/MF A01.

Also available from Supt. of Docs as SN003-003-02763-4. Library of Congress catalog card no. 86-600585.

The accurate determination of isotope abundances by any method requires that the measuring systems be calibrated using well-characterized isotope reference materials. The National Bureau of Standards (NBS) and the Central Bureau for Nuclear Measurements (CBNM) have jointly produced and certified U_3O_8 nondestructive assay (NDA) reference samples to be used for calibrating gamma measurements. Five different uranium abundances were certified (0.31, 0.71, 1.95, 2.95, and 4.46 nominal mass percent, (235)U/U). In the 260 series publication, the material fabrication and certification are described and a discussion of the measurement results affecting the accuracy of gamma spectrometry is given. These certified standards represent the first example of an international effort that establishes traceability to NBS, CBNM, and the basic SI units.

13851 **(RHO-BW-SA—554P) Determination of dissolved gases in basalt groundwater in the Pasco Basin, Washington.** Halko, D.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Sep 1986. Contract AC06-77RL01030. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004213.

The determination of dissolved gases in groundwater is required for complete hydrochemical characterization of the Columbia River Basalt Group beneath the Hanford Site. A gas chromatographic method has been developed for the determination of argon, oxygen, nitrogen, carbon monoxide, carbon dioxide, and methane in groundwater. In addition to a gas chromatograph equipped with thermal conductivity and flame ionization detectors, equipment utilized consists of a purge device that strips these gases from solution for subsequent separation using Molecular Sieve 5A and porous polymer columns. This technique is capable of accommodating pressurized fluid samples collected from the deep aquifers with in situ samplers. The analysis is discussed in detail.

13852 **Simultaneous extraction of trivalent and pentavalent antimony and arsenic species in natural waters for neutron activation analysis.** Mok, W.M.; Wai, C.M. (Univ. of Idaho, Moscow). *Analytical Chemistry;* **59**: No. 2, 233-236(15 Jan 1987).

Antimony(III) and arsenic(III) in aqueous sample can be simultaneously extracted with ammonium pyrrolidinecarbodithioate (APCDT) into chloroform from pH 3 to 6. Extraction of antimony(V) and arsenic(V) can be achieved by reduction with thiosulfate and potassium iodide at pH 1 followed by APCDT extraction at the same pH value. The Sb- and As-PCDT complexes in the organic phase can be back-extracted into a nitric acid solution for neutron activation analysis (NAA). Detection of 10^{-3} μg/L of antimony and arsenic can be achieved by using this extraction method and NAA. Applications of this method to antimony and arsenic speciation studies in natural water systems are discussed.

13853 **Optimization of a flow cell interface for reverse-phase liquid chromatography/Fourier transform infrared spectrometry.** Hellgeth, J.W.; Taylor, L.T. (Virginia Polytechnic Institute and State Univ., Blacksburg). *Analytical Chemistry;* **59**: No. 2, 295-300(15 Jan 1987). Contract FG22-84PC70799.

The further development of a method for on-line aqueous-based reversed-phase high-performance liquid chromatography/Fourier transform infrared spectrometry is described. An improved interface device based upon the postcolumn extraction of solutes into a proper analyte fluid has been constructed. In this fashion, the coupling of the separation to the spectrometer maintains the developed chromatographic resolution and yet retains the spectral integrity of each analyte with modest interferences. The device allows the detection of solutes within the time frame of the chromatographic separation. The apparent limit of detection for compounds containing carbonyl functionalities is on the order of micrograms per component as minimum injectable quantities.

13854 **Sampling and excitation of refractory solids with a theta pinch designed as an atomic emission source.** White, J.S.; Scheeline, A. (Univ. of Illinois, Urbana). *Analytical Chemistry;* **59**: No. 2, 305-309(15 Jan 1987). Contract FG02-84ER13218.

Work with a theta pinch designed as an atomic emission source for solids analysis is reported. Argon at 3.5 torr provided the most intense analyte emission compared to several other gases. A study of the effects of sample positioning provides further understanding of the plasma motion and plasma/sample interactions. Application of the new sample positioning knowledge has resulted in significant increases in analyte emission, as is demonstrated by use of samples of tungsten powder, boron nitride, and aluminum oxide ceramics.

13855 **Fluorescence line-narrowing spectrometry of polycyclic compounds on filter paper substrates.** Vo-Dinh, T.; Suter, G.W.; Kallir, A.J.; Wild, U.P. (Oak Ridge National Lab., TN). *Analytical Chemistry;* **58**: No. 14, 3135-3139(Dec 1986). Contract AC05-84OR21400.

The fluorescence line-narrowing (FLN) technique was used to characterize polynuclear aromatic compounds adsorbed on a simple and practical substrate consisting of a filter paper material. Narrow-based excitation was used to produce highly resolved fluorescence spectra of benzo[a]pyrene, chrysene, and pyrene on Whatman 4 paper substrate at 4 K. The detection of these compounds in a complex mixture was illustrated by the analysis of an unfractionated coal liquid sample.

13856 **Analytical application of laser excited Shpol'skii spectroscopy: direct identification and quantitation of polynuclear aromatic compounds.** Elsaid, A.E. Ames, IA; Iowa State Univ. (1986). 189p. University Microfilms Order No. 86-15,045.Contract W-7405-ENG-82.

Thesis (Ph. D.).

To date, laser excited Shpol'skii spectroscopy has been successfully utilized for the direct selective detection and quantitative determination of a variety of polynuclear aromatic compounds in various matrices. For this technique to gain wider acceptance, a far broader application base needs to be developed. In addition, potential problems that may emerge need to be identified and solutions need to be provided. Finally, an atlas of reference spectra useful for the selective identification of individual polynuclear aromatic compounds needs to be completed. The work reported in this dissertation addresses all of these needs.

13857 **Evaluation of a direct injection nebulizer interface for flow injection analysis and high performance liquid chromatography with inductively coupled plasma-atomic emission spectroscopic detection.** LaFreniere, K.E. Ames, IA; Iowa State Univ. (1986). 202p. University Microfilms Order No. 86-15,061.Contract W-7405-ENG-82.

Thesis (Ph. D.).

A direct injection nebulizer (DIN) was designed, developed and evaluated to determine its potential utilization as an effective interface for flow injection analysis (FIA) and high performance liquid chromatography (HPLC) coupled with inductively coupled plasma-atomic emission spectroscopic detection. The analytical figures of merit for the DIN when used as an interface for FIA-ICP-AES were found to be comparable to or better than those obtained with conventional pneumatic nebulization in terms of limits of detection (LODs), reproducibility, linearity, and interelement effects. In the HPLC mode, the LODDs were found to be comparable to those obtained by continuous-flow sample introduction into the ICP, or inferior by up to only a factor of four. Stable plasma operation was maintained for the DIN sample introduction of a variety of pure organic solvents, including acetonitrile, methanol, methylisobutylketone, and pyridine. The HPLC-DIN-ICP-AES facility was specifically applied for the speciation of inorganic and organometallic species contained in synthetic mixtures, vanilla extracts and a variety of energy-related materials, such as shale oil process water, coal extracts, shale oil, crude oil, and an SRC II. Suggestions for future research are also considered.

13858 **Spatial characterization of pulsed and continuous atom sources.** Huie, C.W. Ames, IA; Iowa State Univ. (1986). 149p. University Microfilms Order No. 86-15,057.Contract W-7405-ENG-82.

Thesis (Ph. D.).

A new concept for the determination of spatially resolved vibrational temperatures in atomic spectroscopic methods is demonstrated. A collimated laser beam is coupled to a vidicon camera to allow spatial mapping of absorption in flames. Vibrational temperature for each spatial location of the flame can be calculated by measuring the relative intensities of absorption from different vibrational levels in the ground states of the molecules. Temperature information generated by this system is very helpful to the understanding of dissociation and recombination of molecules in flames. The laser microprobe is a powerful technique for in situ elemental analysis of a small spot on the surfaces of any materials. Optimizations of the laser microprobe require the understanding of the fundamental processes that occur in the formation of the laser-generated plume. The availability of dynamic information such as spatial and temporal distribution of atoms and molecules is very important for the study of vaporization mechanisms. The spatial distribution of sodium dimers in a lower-generated plume is obtained for the first time in the laboratory. A new imaging instrument based on acousto-optic deflector has been developed for diagnostic studies of pulsed atoms sources. The device which has the capability of deflecting a laser beam across a spatial region of interest in the microsecond regime so that the transient events can be recorded in real-time is described. The instrument has been applied to the acquisition of spatially resolved scattering profiles of particles and absorption profiles of atoms in a laser microprobe.

13859 **Capillary column gas chromatography, resonance enhanced multiphoton ionization, time-of-flight mass spectrometry, laser-induced fluorescence, flame ionization detection system for the determination of polynuclear aromatic compounds in complex mixtures.** Dobson, R.L.M. Ames, IA; Iowa State Univ. (1986). 179p. University Microfilms Order No. 86-15,043.Contract W-7405-ENG-82.

Thesis (Ph. D.).

A method is reached to fully characterize the polynuclear aromatic hydrocarbons (PAC) that have been deemed to be highly mutagenic or carcinogenic. A multidimensional, laser-based analytical instrument has been developed that, when utilized to the full extent of its capabilities could be the solution to this complex analytical problem. The overall technique is termed Capillary Column Gas Chromatography, Resonance Enhanced Multiphoton Ionization, Time-of-Flight Mass Spectrometry, Laser-induced Fluorescence, with parallel Flame Ionization Detection (CC/GC-REMPI-TOF/MS-LIF-FID). This system combines the selectivity of two complementary laser-based methods, REMPI and LIF, with an extremely powerful and proven analytical tool, GC/MS. The GC effluent passes through the ion source of a TOF/MS, where it is interrogated by a tunable ultraviolet laser beam. Thus, PAC and other absorbing species may be selectively excited and/or ionized in the presence of nonabsorbing components. All laser-analyte interaction products (actions, electrons, and photons) are simultaneously monitored utilizing the TOF/MS, a total electron current detector (TECD), and a LIF detector. The main advantage of this technique is that all analytically useful data for each absorbing chromatographic eluent may be collected on-the-fly. The simultaneous availability of this information simplifies the characterization task. The present absolute detection limits for several PAC have been determined to be low picogram range. Also, a linear dynamic range of approximately four orders of magnitude has been established for the TECD, indicating that this technique is both sensitive and quantitative. Further, the use of deuterated analogs, of selected PAC, as internal reference standards greatly assists in quantitation.

13860 **Continuum flow sampling mass spectrometer for elemental analysis with an inductively coupled plasma ion source.** Olivares, J.A. Ames, IA; Iowa State Univ. (1985). 109p. University Microfilms Order No. 85-24,682.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The sampling of ions from an atmospheric pressure inductively coupled plasma for mass spectrometry (ICP-MS) with a supersonic nozzle and skimmer is shown to follow similar behavior found for neutral beam studies and of ion extraction from other plasmas and flames. The dependence of count rates for metal oxide and doubly charged ions on ICP operating parameters, and sampling interface configuration are discussed for this instrument. A simple method is described for the approximate measurement of the ion energy distribution in ICP-MS. The average ion kinetic energy, kinetic energy spread, and maximum kinetic energy are evaluated from a plot of ion signal as a function of retarding voltage applied to the quadrupole mass analyzer. The effects of plasma operating parameters on ion signals and energies are described. The interference on the ionization of cobalt by five salts, NaCl, $MgCl_2$, NH_4I, NH_4Br and NH_4Cl, in an ICP is first considered theoretically and subsequently the theoretical trends are established experimentally by ICP-MS. The interference trends are found to be in the order of the most easily ionized element in the matrix salt, i.e., Na > Mg > I > Br > Cl.

13861 **New design for helium ionization detection.** Brazell, R.S.; Todd, R.A. (Oak Ridge National Lab., TN). *Journal of Chromatography;* **302**: 257-268(1984). Contract AC05-84OR21400.

A voltage pulse generator with variable width and interval adjust has been designed and coupled to a helium ionization detector to examine the response characteristics of sampling the detector cell's output current in a discontinuous mode. The pulser is capable of operating from 0 to 500 V at less than 1 kHz up to 333 kHz at the highest voltage. The response of the modified detector to a standard gas mixture containing Ne, H_2, Ar, O_2, N_2 and CH_4 has been examined as a function of frequency, duty cycle, and voltage. An inversion in the signal polarity for some gases was observed at

certain frequency and duty cycle combinations. Noise and background current levels were significantly reduced in the pulsed mode as compared to d.c. operation. It has also been determined that the detector can be operated at higher voltages in the pulsed mode before the cell current breaks down.

13862 **Global optimization strategy for gas-chromatographic separations.** Laub, R.J. (San Diego State Univ., CA). pp 249-341 of Physical methods in modern chemical analysis. Volume 3. New York, NY; Academic Press, Inc. (1983).

This publication comprises an effort to bridge the gap between empirical and rational approaches to gas chromatography and to demonstrate in addition that the situation is not as problematical as is generally supposed. The material is divided into five sections entitled: Introduction, a Global Optimization Strategy, Practical Application of the Optimization Strategy, Use of the Optimization Strategy for the Analysis of Mixtures of Initially Unknown Content and Complexity, and Contemporary Developments. 114 references, 46 figures, 14 tables.

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REFER ALSO TO CITATION(S) 13032, 13034, 13035, 13065, 13166, 13231, 13338, 13369, 13788, 13827, 13856, 13858, 13918

13863 **(AD-A—173018/3/XAB) Comparison of 2-PAM and pro-2-PAM containing treatment regimens as antagonists of nerve agent-induced lethality and incapacitation. Final report, June 1981-December 1985.** Talbot, B.G.; Harris, L.W.; Lennox, W.J.; Anderson, D.A.; Green, M.D. (Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD (USA)). Sep 1986. 26p. (USAMRICD-SP—86-012). NTIS, PC A03/MF A01.

In vivo, (2-Puridine Aldoxine Methioidide) reactivates phosphonylated acetylcholinesterase AChE peripherally, but is effective in restoring AChE centrally because the quaternary nitrogen atom of 2-PAM prevents penetration of the brain. The problem was solved by the synthesis of the 1,6-dihyropyridine derivative of 2-PAM, pro-2-PAM (PP). Functional brain AChE is related to return to control performance on an accelerating rotarod (ARR) in animals intoxicated with soman. There should be a difference in the time to recovery of control ARR performance between PP- and 2-PAM-treated, sarin-intoxicated animals. In the present work, an ARR decrement free dosage (DFD) of each of these oximes (30 mg/kg, im) in combination with DFD of atropine (A) and mecamylamine (M) (0.79 mg/kg each, im) was used as pretreatment against sarin-induced deficit. The same antidotes were given pre-and post-intoxication (as pretreatment and therapy) to anatagonize sarin-induced lethality; the PP containing antidote provided significantly greater protection than that by the 2-PAM antidote which in turn provided significant protection over control. Neither antidote when given as pretreatment and therapy provided protection above control against soman-induced physical incapacitation, but they were equally effective in antagonizing VX-induced physical incapacitation. The reversal of sarin-induced physical debilitation reflects the central actions of PP and supports the notion that functional brain AChE activity is essential for rapid recovery from the debilitating effeclts on nerve agents.

13864 **(AD-A—173177/7/XAB) Hydrolysis of 2-chloroethyl ethyl sulfide in aqueous ethanol-water and acetone-water mixtures. Technical report, October 1983-December 1984.** Yang; Ward, J.R.; Luteran. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Sep 1986. 54p. (CRDEC-TR—86048). NTIS, PC A04/MF A01.

The rate of hydrolysis of 2,2-dichlorodiethyl sulfide (mustard) was investigated at 25 C in water in the presence of 5% by volume acetone. The results led to a proposed SN1 mechanism using a sulfonium ion intermediate. The hydrolysis of a less-toxic and commonly used mustard simulant, 2-chloroethyl ethyl sulfide (CEES), however, was never investigated. This study measures the rates of hydrolysis of CEES over a wide range of temperatures in binary aqueous mixtures of ethanol-water and acetone-water. The presence of the organic-solvent component was necessary because the rate of dissolution of CEES in pure water was too slow for accurate reaction rate measurements. It was also expected that an investigation in the activation parameters and their variation with solvent composition should provide further evidence of the reaction mechanism. These variations are expected to follow similar patterns as that of t-butyl chloride (TBC), a frequently used model for SN1 hydrolysis. Therefore, rate constants of TBC hydrolysis in the same solvent mixtures were also measured for comparison with CEES and for comparison with earlier work.

13865 **(AD-A—173233/8/XAB) Fourier-transform infrared study of 2-chloroethyl ethyl sulfide and water in a circle cell. Technical report, January-December 1984.** Davis, D.M.; Yang. (Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA)). Sep 1986. 15p. (CRDEC-TR—86046). NTIS, PC A02/MF A01.

The changes in composition of two-phase reacting mixtures of 2-chloroethyl ethyl sulfide (CEES) and water in an internally reflective (ZnSe crystal) circle cell were followed with time by Fourier-transform infrared techniques at room temperature. No detectable intermediate compounds or by-products were found during the first 2 hours of reaction, nor in the final mixture, which formed a single phase but still contained a detectable amount of CEES after 14 days. It was concluded that the possible reaction paths leading to the formation of by-products were negligible compared to the major hydrolysis products 2-hydroxyethyl ethyl sulfide (HEES) and HCl, which significantly retarded further hydrolysis of CEES by enhancing the reverse reaction.

13866 **(AD-A—173803/8/XAB) Cobalt(iii) chelates as potential nerve agent antidotes. Annual report, 15 March 1983-30 September 1984.** Bedford, C.D.; Wilson, R.B. (SRI International, Menlo Park, CA (USA)). 31 Oct 1985. 80p. NTIS, PC A05/MF A01.

Cobalt(III) chelates were investigated as potential reactivators for GD-inhibited aged acetylcholinesterase. Twelve cobalt(III) amine chelate complexes were synthesized, characterized, and submitted to WRAIR for in-vivo testing. The compounds are active catalysts for the hydrolysis of anionic dealkylated phosphonate esters, which are models for GD-inhibited aged enzyme. However, the compounds are not active catalysts for the hydrolysis of neutral phosphonate esters, which are models for GD-inhibited unaged enzyme. Thus these cobalt (III) chelates would be effective reactivators only in combination with more traditional therapies.

13867 **(AD-A—174416/8/XAB) Cobalt(iii) chelates as potential nerve-agent antidotes. Annual report, 15 March 1982-14 March 1983.** Bedford, C.D.; Wilson, R.B.; Fleming, R.H.; Hediger; Lee. (SRI International, Menlo Park, CA (USA)). 24 Feb 1986. 53p. NTIS, PC A04/MF A01.

Cobalt (III) chelates were investigated as potential reactivators for GD-inhibited aged acetylcholinesterase. Four cobalt (III) amine chelate complexes were synthesized, characterized, and submitted to WRAIR for in-vivo testing. The compounds are active catalysts for the hydrolysis of anionic dealkylated phosphonate esters, which are models for GD-inhibited aged enzyme. However, the compounds are not active catalysts for the hydrolysis of neutral phosphonate esters, which are models for GD-inhibited unaged enzymes. Thus, these cobalt (III) chelates would be effective reactivators only in combination with more-traditional therapies. A quadrupole pH stat was designed, constructed, and interfaced with a computer system to assist in the rapid acquisition of accurate kinetic data.

13868 **(DOE/ER/13436—1) The generalized van der Waals theory of pure fluids and mixtures: Annual report for September 1985 to November 1986.** Sandler, S.I. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 1986. Contract FG02-85ER13436. 5p. NTIS, PC A02. File Number DE87003416.

The objective of the work is to use the generalized van der Waals theory, as derived earlier ["The Generalized van der Waals Partition Function I. Basic Theory" by S.I. Sandler, Fluid Phase Equilibria 19, 233 (1985)] to: (1) understand the molecular level assumptions inherent in current thermodynamic models; (2) use theory and computer simulation studies to test these assumptions;

and (3) develop new, improved thermodynamic models based on better molecular level assumptions. From such a fundamental study, thermodynamic models will be developed that will be applicable to mixtures of molecules of widely different size and functionality, as occurs in the processing of heavy oils, coal liquids and other synthetic fuels. An important aspect of our work is to reduce our fundamental theoretical developments to engineering practice through extensive testing and evaluation with experimental data on real mixtures. During the first year of this project important progress was made in the areas specified in the original proposal, as well as several subsidiary areas identified as the work progressed. Some of this work has been written up and submitted for publication. Manuscripts acknowledging DOE support, together with a very brief description, are listed herein.

13869 (IAEA-TECDOC—367) **Mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment. The provisional document prepared by Ad hoc consultants meetings organized by the IAEA and held in Vienna, 12-16 December 1983 and 10-14 December 1984.** (International Atomic Energy Agency, Vienna (Austria)). Mar 1986. 110p. (In French). (CONF-8412120—). NTIS (US Sales Only), PC A06/MF A01. File Number DE87701285.

From Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment; Vienna, Austria (10 Dec 1984).

This document is divided into the following chapters: thermodynamics, kinetics of the solid-liquid interaction processes, methodology of the experiments in closed chemical reactors, physico-chemical interactions in the liquid flow and conclusions. Separate abstracts were prepared for each of the 4 chapters in this document. Figs and tabs.

13870 (IAEA-TECDOC—367, pp 11-30) **Thermodynamics.** Laudelout, H. (Universite Catholique de Louvain, Louvain-la-Neuve, Belgium. Dept. des Sciences du Sol). Mar 1986. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87701285. (CONF-8412120—).

From Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment; Vienna, Austria (10 Dec 1984).

The thermodynamics of the solid-liquid interaction and mass transfer in aqueous solutions is presented. The applications in the ion exchange and chemical reactions are discussed. 2 refs, 2 figs.

13871 (IAEA-TECDOC—367, pp 31-47) **Kinetics of the solid-liquid interaction processes.** Schweich, D. (Laboratoire des Sciences du Genie Chimique, Nancy, France). Mar 1986. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87701285. (CONF-8412120—).

From Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment; Vienna, Austria (10 Dec 1984).

The kinetics simulation of the solid-liquid interaction processes and mass transfer in aqueous solutions is presented. The applications in the isotopic exchange and chemical reactions are discussed. 3 refs, 1 tab.

13872 (IAEA-TECDOC—367, pp 49-58) **Experimental methodology in the closed chemical reactors.** Schweich, D. (Laboratoire des Sciences du Genie Chimique, Nancy, France). Mar 1986. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87701285. (CONF-8412120—).

From Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment; Vienna, Austria (10 Dec 1984).

The experimental methodology in closed chemical reactors is discussed. The modeling of the reaction kinetics, equilibrium conditions and thermodynamics of the solid-liquid interaction processes and mass transfer in aqueous solutions is presented. 2 refs.

13873 (IAEA-TECDOC—367, pp 59-107) **Physico-chemical interactions in liquid flow.** Schweich, D.; Sardin, M. (Laboratoire des Sciences du Genie Chimique, Nancy, France). Mar 1986. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE87701285. (CONF-8412120—).

From Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment; Vienna, Austria (10 Dec 1984).

The modeling of the solid-liquid interaction, mass transfer and physico-chemical processes in liquid flow is discussed. 27 refs, 30 figs, 2 tabs.

13874 (INIS-SU—392, pp 245) **Structure of internal conversion spectra of sup(99m)Tc E3-transition in thin films of technetium alloys with Ni, Ag, Au, Pt, Sb, Sn and Pb.** Gerasimov, V.N.; Kulakov, V.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

13875 **(Juel—2005) Thermodynamic properties of hydrogen, deuterium and tritium in vanadium.** Bleichert, H.P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). Jul 1985. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE87751170.

An UHV apparatus was built for the safe handling of 100 Ci tritium. Electrical resistivity measurements on tritium doped vanadium samples were performed for the first time. For the increase of the specific electrical resistivity we obtained Δrho/Δ/sub x/=0,85 μΩcm/0,01. The solubility of protium and deuterium in the dilute α-phase was measured in a large temperature (40-800/sup 0/C) and pressure range (10/sup -6/-2 x 10/sup 3/ mbar). The solubility behavior of tritium was investigated in the temperature range from 150 to 600/sup 0/C at equilibrium pressures from 10/sup -4/ to 200 mbar. From these solubility measurements the enthalpies and entropies of solution were determined for the three isotopes. The isotope effect of the solubility can be described by a simple model, where the different isotopes behave as Einstein-oscillators in a harmonic potential. The difference of the energy levels is due to the different masses. The energy level of the ground state for protium is proportional to $\sqrt{2}(\sqrt{3})$ times larger than the corresponding levels of deuterium (tritium).

13876 **(N—87-11671) Ammonia-water phase diagram and its implications for icy satellites.** Johnson, M.L.; Nicol, M. (California Univ., Los Angeles (USA)). 1986. 53p. (NASA-CR—179881; NAS—1.26:179881). NTIS, PC A04/MF A01.

A Holzapfel-type diamond anvil cell is used to determine the NH_3 - H_2O phase diagram in the region from 0 to 33 mole percent NH_3, 240 to 370 K, and 0 to 5 GPa. The following phases were identified: liquid; water ices Ih, III, V, VI, VII, and VIII; ammonia monohydrate, $NH_3.H_2O$; and ammonia dihydrate $NH_3.2H_2O$. Ammonia dihydrate becomes prominent at moderate pressures (less than 1 GPa), with planetologically significant implications, including the possibility of layering in Titan's magma ocean.

13877 **(PB—87-100616/XAB) Using isotope dilution mass spectrometry to determine aqueous trichloroacetic acid.** Norwood, D.L.; Christman, R.F.; Johnson, J.D.; Hass, J.R. (North Carolina Univ., Chapel Hill (USA)). 1986. 9p. NTIS, PC A02/MF A01.

The development, verification, and application of a method based on isotope-dilution gas chromatography-mass spectrometry to determine aqueous trichloroacetic acid (TCAA) at the micrograms per litre level are described. The simultaneous determination of aqueous chloroform is also demonstrated. Trichloroacetic acid is shown to be a significant by-product of the chlorination of raw waters in the laboratory and to constitute a large fraction of the total organic halide (TOX) formed. Analysis of finished-water samples indicated that TCAA, like trihalomethanes is ubiquitous. Posi-

tive correlations exist between the levels of TCAA in laboratory-chlorinated raw waters and in finished waters and measured TOX.

13878 Structure of the intermediate Zr_2Br_2H by neutron diffraction and its structural and bonding relationships to other phases. Wijeyesekera, S.D.; Corbett, J.D. (Iowa State Univ., Ames). *Inorganic Chemistry;* **25**: No. 26, 4709-4714(17 Dec 1986). Contract W-7405-ENG-82.

The structures of the isomorphous Zr_2Br_2D and Zr_2Br_2H have been solved and refined by using Rietveld techniques on pulsed neutron diffraction data obtained from the powdered samples at 14 K (C2/m, a = 19.437 (3) A, b = 3.5253 (4) A, c = 5.9036 (6) A, β = 100.98 (1)°, R(profile)/R(expected) = 2.44 for the deuteride). The structure consists of layers sequenced Br-Zr-H-H-Zr-Br and arranged such that hydride lies in zigzag chains of distorted metal tetrahedra (or butterflies) (d(Zr-D) = 2.03-2.20 A; d(D-D) = 2.93 A). The structure is intermediate between ZrBr (ccp) and ZrBrH (hcp heavy atoms, double H in trigonal-antiprismatic interstices) and can be generated by concerted intraslab slippage from either. The hemihydride effectively retains most of the strong Zr-Zr bonding of the ZrBr parent while tetrahedral bonding of hydrogen to metal is gained that is absent in ZrBrH. The energetics associated with the contrasting structures of YClH/sub x/ (ZrBr type) and ZrBrH are considered in terms of the results of extended-Hueckel band calculations. 25 references, 7 figures, 3 tables.

13879 High-nuclearity clusters containing carbene ligands. Synthesis, structural analyses, and isomerization of disulfidohexaosmium carbonyl cluster compounds containing secondary (dimethylamino) carbene ligands. Adams, R.D.; Babin, J.E.; Kim, H. (Univ. of South Carolina, Columbia). *Inorganic Chemistry;* **25**: No. 24, 4319-4320(19 Nov 1986).

The trimethylamine complex $Os_6(CO)_{18}(NMe_3)(\mu_3\text{-}SC_6H_4)(\mu\text{-}H)_2$ (1) was prepared as a mixture of two slowly interconverting isomers. Refluxing 1 in a heptane solution yielded a mixture of three new hexaosmium clusters that are all isomers with the formula $Os_6(CO)_{16}[C(H)NMe_2](\mu_3\text{-}S)(\mu\text{-}H)_2$. This reaction represents another example of the arene elimination/cluster condensation sequence that was observed and previously reported for $Os_3(CO)_{10}(\mu\text{-}SPh)(\mu\text{-}H)$. 18 references, 2 figures.

13880 Alcohol synthesis from CO and H/sub 2/ over molybdenum sulfide. The effect of pressure and promotion by potassium carbonate. Youchang, X.; Naasz, B.M.; Somorjai, G.A. (Lawrence Berkeley Lab., CA, USA). *Applied Catalysis;* **27**: No. 2, 233-241(14 Nov 1986).

Molybdenum disulfide is an active catalyst for the formation of alkanes from CO + H/sub 2/. Addition of K/sub 2/CO/sub 3/ as a promoter greatly increases the selectivity to alcohols. The alcohol production is also dependent on the pressure, higher pressures of either CO or H/sub 2/ lead to significant increases in the alcohol yield. In particular, at 2000 p.s.i.g. and 250 C, a catalyst with 30% by weight K/sub 2/CO/sub 3/ produces a total alcohol yield of 90%, mostly methanol. 20 refs.

13881 Hydrolysis of the nickel-carbon bond of organonickel tetramethylcyclam complexes. Ram, M.S.; Espenson, J.H.; Bakac, A. (Iowa State Univ., Ames). *Inorganic Chemistry;* **25**: No. 23, 4115-4118(5 Nov 1986). Contract W-7405-ENG-82.

The cationic organometallic complexes (1R,4S,8R,11S)-$RNi(tmc)^+$ (where tmc = 1,4,8,11-tetramethyl-1,4,8,11-tetraazacyclotetradecane) hydrolyze in alkaline, aqueous solutions to yield the alkane RH and $HONi(tmc)^+$, the hydroxonickel(II) macrocycle. The rates of reaction are independent of pH (for 9 < pH < 13). Aside from a few special cases, the hydrolysis rate constants are rather insensitive to the variation of R in a series of 20 compounds that includes alkyls (R = CH_3, C_2H_5, n-C_3H_7, i-C_3H_7, sec-C_4H_9, $CH_3C_6H_5$), cyclopropyl, and substituted alkyls (e.g., (CH_2)/sub n/ X, with X = Br, Cl, OH, and OTs; n = 3-6). These complexes, and also such bimetallic analogues as $[Ni(tmc)(CH_2)_8Cr([15]aneN_4)^{3+}]$, have k/sub hyd/ in the range (0.8-2.7) x 10^{-3} s^{-1} at 25.0°C. The activation parameters also span a narrow range, with $\Delta H^{\ddagger}$ ~ 16 kcal mol^{-1} and $\Delta S^{\ddagger}$ ~ -14 cal mol^{-1} K^{-1}. The solvent deuterium kinetic isotope effect determined for several of these complexes is appreciable, k/sub H//k/sub D/ = 2.2-3.5, suggesting appreciable proton transfer from water to the incipient hydrocarbon in the transition state. Nucleophilic assistance by OH^-, OAc^-, and NH_3 was not observed. Exceptions to the general pattern were noted. The most striking cases are R = $(CH_2)_3OH$, where the enhanced rate of hydrolysis (k/sub hyd/ = 0.23 s^{-1}) suggests assistance from the pendant OH group in a cyclic transition state and cycloalkyls (other than cyclopropyl), where the enhanced rates (e.g., cyclobutyl ~ 0.2 s^{-1} and cyclopentyl > 2 s^{-1}) suggest an acceleration by the strain of the nickel-carbon bond. In acidic solutions, the hydrolysis rate is enhanced because of direct protonolysis. The bimolecular reaction between $C_2H_5Ni(tmc)^+$ and H_3O^+ has k = 5 x 10^5 M^{-1} s^{-1}. 26 references, 3 figures, 3 tables.

13882 Trialkoxynitridomolybdenum compounds: $(RO)_3Mo$ identical with N. Preparation, structures (R = t-Bu and i-Pr), and comparisons with a tungsten analogue (R = t-Bu). Chan, D.M.T.; Chisholm, M.H.; Folting, K.; Huffman, J.C.; Marchant, N.S. (E.I. du Pont de Nemours and Co., Inc., Wilmington, DE). *Inorganic Chemistry;* **25**: No. 23, 4170-4174(5 Nov 1986).

The compound $(t\text{-}BuO)_3Mo$ identical with N is formed in the reaction between Cl_3Mo identical with N and LiO-t-Bu (3 equiv) in THF and is obtained as a white crystalline compound by either sublimation (85°C, 5 x 10^{-3} torr) or recrystallization from toluene. In the solid state the compound forms a linear polymer $[(t\text{-}BuO)_3Mo$ identical with N] involving alternating short, 1.66 (1) A, and long, 2.86 (2) A, Mo-N bonds, corresponding formally to triple and weak dative bonds, respectively. In benzene solution, a cryoscopic molecular weight determination indicates the monomeric species is present. The solubilities of the compounds $[(t\text{-}BuO)_3M$ identical with N] where M = Mo and W differ quite markedly, with the molybdenum compound being appreciably more soluble in aromatic solvents. It is suggested that this results from different M identical with N - M bonding along the infinite chain with the tungsten compound having a more basic or nucleophilic nitrogen atom. This suggestion finds support from MO calculations employing the Fenske-Hall method. The W identical with N distance is significantly longer (1.740 (15) A) and the W-N distance shorter (2.661 (15) A). Furthermore, the molybdenum and tungsten compounds differ in their reactivity toward alcohols, yielding, respectively, $(RO)_3Mo$ identical with N and $W(OR)_6$ (R = i-Pr, neo-Pe, Et) and ammonia. These results are compared with other nitrido compounds of molybdenum and tungsten. Crystal data for $(t\text{-}BuO)_3Mo$ identical with N is presented. 19 references, 3 figures, 4 tables.

13883 Mixed-valence titanium(III)-titanium(IV) tetramer and related compounds. Maya, L. (Oak Ridge National Lab., TN). *Inorganic Chemistry;* **25**: No. 23, 4213-4217(5 Nov 1986). Contract AC05-84OR21400.

The mixed-valence compound $[NH_4^+ \text{ x } NH_3]_2[Ti_4Br_{12}(NH_3)_{12}^{2-}]$ was produced in the reaction of potassium borohydride and titanium(IV) bromide in liquid ammonia at room temperature. Similar ammonium salts of either Ti(III) or Ti(IV) were also prepared. The reactions of these compounds with sodium acetylide in liquid ammonia evolve acetylene equivalent to the ammonium ions present, thus providing the charge of the complex, and yield novel titanium acetylide derivatives. The acetylides convert into titanium carbonitride upon thermal treatment to 800°C. 23 references, 2 tables.

13884 Orthogonal approximation and classification of molecules for zero-point energy shifts due to H/D isotope substitutions. Oi, T.; Ishida, T. (Sophia Univ., Tokyo, Japan). *Bulletin of the Chemical Society of Japan;* **59**: No. 11, 3669-3671(1986). Contract AC02-80ER10612.

Dozens of hydrogenous molecules have been classified for the approximation of the H/D isotope shifts in zero-point energies. The classification, based on their molecular structures, has yielded relative approximation errors of better than one percent with a few predictable exceptions. A further refinement of the classification has been suggested. 18 references, 1 figure, 1 table.

13885 Nonphotochemical hole burning of organic dyes and rare earth ions in polymers and glasses: a probe of the amorphous state. Fearey, B.L. Ames, IA; Iowa State Univ. (1986). 224p. University Microfilms Order No. 86-15,047.Contract W-7405-ENG-82.

Thesis (Ph. D.).

New and in depth studies of amorphous materials (e.g., glasses and polymers) probed via the low temperature optical technique of nonphotochemical hole burning [NPHB] are presented. An extensive review of the phenomena itself, along with selected topics involving the use of persistent hole burning techniques, is given. In addition, a semi-complete tabulation of essentially all hole burning systems to date is included. The deuteration dependence in an amorphous host is examined for the system of tetracene in an ethanol/methanol mixture. The results illustrate the importance of hydrogen bonding in the hole burning process. The discovery of a highly efficient (or facile) class of hole burning systems, i.e., ionic dyes in hydroxylated polymers (i.e., poly(vinyl alcohol) [PVOH] and poly(acrylic acid) [PAA]), is presented and discussed. Ultrafast relaxation processes (i.e., dephasing) are studied for the system of cresyl violet perchlorate [CV] in PVOH. Further, for the first time, NPHB of rare earth ions, specifically Pr^{+3} and Nd^{+3}, in a soft organic glass (i.e., PVOH) is discussed briefly. Detailed experimental results of two related phenomena, spontaneous hole filling [SPHF] and laser induced hole filling [LIHF], are presented and discussed for several systems: rhodamine 560 perchlorate [R560], rhodamine 640 perchlorate [R640], CV, Pr^{+3} and $Nd\mu^{3}$ in either PVOH or PAA. A theoretical model is developed for SPHF. The model invokes a correlated feedback mechanism from the anti-hole, which is able to account for the fact that no line broadening is observed. A tentative model is also presented for the phenomenon of LIHF.

13886 Oxidative and electrophilic pathways in the reactions of organochromium(III) complexes with nitrous acid and tris(2,2'-bipyridyl)ruthenium(III). Melton, J.D. Ames, IA; Iowa State Univ. (1986). 139p. University Microfilms Order No. 86-15,069.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The kinetics and mechanism of the reactions of nitrous acid with pentaaquoorganochromium(III) complexes were studied. Nitrous acid reacts with $(H_2O)_5CrR^{2+}$ complexes via an NO^+ intermediate by either an electrophilic or electron transfer mechanism depending on the nature of the R group. The lack of steric effects for the reactions of the alkyl-chromium complexes, and the detection of Cr^{2+} as an intermediate in the reactions of the α-hydroxy- and α-alkoxyalkylchromium complexes suggests that these complexes react with HONO by an electron transfer mechanism. A mechanism has been proposed in which NO^+ is formed which then oxidizes CrR^{2+} by one electron to give CrR^{3+}. This species decomposes to Cr^{3+} and R/sup ./ when R is an alkyl group, but forms Cr^{2+} and ROH when R is an α-hydroxy-or α-alkoxyalkyl group. R/sup ./ and Cr^{2+} react with the NO formed in the reaction to give RNO and $CrNO^{2+}$, respectively. In contrast, aralkylchromium(III) complexes react with nitrous acid by an electrophilic mechanism as indicated by the products and correlations of the rate constants with other electrophilic reactions in the literature. Photochemically generated tris(2,2'-bipyridyl)-ruthenium(III) oxidizes a range of pentaaquoorganochromium(III) complexes by one electron. The trends in the rate constants and the usual behavior of $Ru(bpy)_3^{3+}$ suggest that electron transfer is occurring by an outersphere mechanism. In the case of $CrCH_2CH_3^{2+}$, the intermediate formed, $CrCH_2CH_3^{3+}$, decays to Cr^{3+} and $.CH_2CH_3$ as shown by kinetic studies and a product analysis.

13887 Thermochemistry of the decomposition of nitramines in the gas phase. Melius, C.F.; Binkley, J.S. (Sandia National Labs.). pp 42 of Proceedings of the 21st symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The mechanism of decomposition of nitramines has been studied theoretically using the quantum chemical Bond-Additivity-Corrected Moller-Plesset fourth order perturbation theory method (BAC-MP4). The BAC-MP4 method is used to calculate the heats of formation and free energies of the nitramines H/sub 2/NNO/sub 2/ and CH/sub 3/NHNO/sub 2/ as well as the molecular radical species which might arise from the decomposition process. The thermochemical properties of transition state activated complexes have also been calculated. The bond energies and dissociation energies obtained from these calculations are used to determine decomposition pathways of propellant nitramines such as HMX and RDX. The results indicate that at high temperatures, bond fission of the nitro group (with a bond energy of ≈49 kcal-mole/sup -1/) should play an important role as the initial decomposition step. At lower temperatures, the five-center HONO elimination with a dissociation energy of ≈41 kcal-mole/sup -1/ is possible but has a small pre-exponential factor compared to experimental decomposition rates. The authors propose a new decomposition mechanism, involving attack by autocatalytic generated H atoms, which provides a lower energy pathway (≈27 kcal-mole /sup -1/) which can form nitrosamines as intermediate products leading to N/sub 2/O formation. The H atom attack can also lead to HCN and NO/sub 2/ formation through pathways analogous to the initial N-NO/sub 2/ bond breading process.

13888 Quasi-classical and transition state calculations of the H/sub 2/ + OH → H/sub 2/O + H rate coefficient. Brown, N.J.; Rashed, O.; Edlin, A. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). pp 187 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract AC03-76SF00098.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Relative to experimental values, the rate coefficients determined with quasi-classical dynamics are too high especially at lower temperatures. The authors attribute the lack of agreement with experiment to the failure of a quasi-classical calculation to properly account for zero-point energy effects.

13889 The reaction of atomic hydrogen with carbon monoxide. Wagner, A.F.; Harding, L.B. (Chemistry Div., Argonne National Lab., Argonne, IL 60439). pp 141 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The thermal dissociation of HCO in the presence of a buffer gas M, HCO + M → H + CO + M, and the reverse addition process, H + CO + M → HCO + M, are studied at an RRKM level using variants of a calculated global potential energy surface.

13890 The high temperature pyrolysis of toluene. Pamidimukkala, K.M.; Kern, R.D.; Patel, M.R.; Wei, H.C.; Kiefer, J.H. (Dept. of Chemistry, Univ. of New Orleans, New Orleans, LA 70148). pp 137 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The thermal decomposition of toluene displays nearly all of the complications which occur in unimolecular decay kinetics: (a) the possibility of more than one dissociation channel; (b) an important contribution by recombination and other secondary processes; (c) falloff effects in both primary and secondary unimolecular processes; (d) discrepancies between measured rates for key reactions, and (e) a lack of thermodynamic property information for several important species. The authors have investigated this reaction by two independent shock-tube techniques: time-of-flight mass spectrometry and laser schlieren densitometry.

13891 Application of the flash photolysis-shock tube technique to the measurement of the equilibrium constant for the reaction: H + NH/sub 3/ ⇌ H/sub 2/ + NH/sub 2/. Sutherland, J.W.; Michael, J.V. (Brookhaven National Lab., Dept. of Applied Science, Upton, NY 11973). pp 100 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract AC02-76CH00016.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

In this paper, the experimental measurement of the equilibrium constant K/sub 1/ is reported for the temperature range 900K to 1620K.

13892 **Description of chemical reactions by the method of the full optimized reaction space. The ring-opening of unsubstituted and substituted cyclopropylidene to allene.** Valtazanos, P. Ames, IA; Iowa State Univ. (1985). 195p. University Microfilms Order No. 85-24,705.Contract W-7405-ENG-82.

Thesis (Ph. D.).

The ring-opening reaction of singlet cyclopropylidene to singlet D/sub 2d/ allene is studied by means of ab-initio FORS-MCSCF calculations. The energy surface is determined for many intermediate geometries defined by the C-C-C opening angle and the two CH_2 rotation angles. For each choice of these three variables, the remaining twelve internal coordinates are relaxed by energy minimization. The results obtained differ markedly from those of earlier, less sophisticated calculations. As the C-C-C angle opens, the reaction is found to proceed first on a disrotatory pathway uphill to the transition region around a C-C-C angle of 84°, where the reaction path bifurcates. It then follows one of two more or less conrotatory downhill pathways. From an opening angle of about 100° on there exists a state of free synchronized disrotatory motion in the molecule. It is shown that the reaction of the unsubstituted species is non-stereospecific. The characteristics of the bifurcating transition region, the first one ever found for a chemical reaction, are examined in detail and the theory governing similar surfaces is developed and generalized. It is shown that for a surface to exhibit such a bifurcation, a Valley Ridge Inflection (VRI) point must be present. The geometries are first calculated using a minimal basis set. Based on these geometries, extended basis set calculations (including polarization functions) are performed for key points along the reaction path. The main effect of this basis set improvement is a substantive lowering of the ring-opening barrier.

13893 **New phases and chemical reactions in solid CO under pressure.** Mills, R.L.; Schiferl, D.; Katz, A.I.; Olinger, B.W. (Los Alamos National Lab., NM). *Journal de Physique (Paris), Supplement;* **45**: No. 11, C8.187-C8.190(Nov 1984).

The phase diagram of solid carbon monoxide was determined by x-ray diffraction and Raman spectroscopy from 15 to 297 K at pressures from 1.0 to 10.0 GPa. At low temperature a transition occurs near 3.4 GPa from the known α-phase (space group $P2_13$) to a new epsilon-phase (structure unknown), rather than to the predicted γ-phase ($P4_2/mnm$). A transformation from β-CO (space group $P6_3/mmc$) into a new δ-phase ($Pm3n$) was found near 5.2 GPa at room temperature. Above about 4.6 GPa and 80 K, CO reacts photochemically when irradiated with visible laser light. The photoreactivity may be associated with the formation of a yellow polymer, which can be recovered at zero pressure. Electron spectroscopy for chemical analysis measurements indicate that the polymer is composed of carbon suboxide (C_3O_2)/sub x/. 19 references, 1 figure, 1 table.

13894 **Two-dimensional J spectra in solids.** Mayne, C.L.; Pugmire, R.J.; Grant, D.M. (Univ. of Utah, Salt Lake City). *Journal of Magnetic Resonance;* **56**: 151-153(1984). Contract FG22-82PC50812.

Spectra similar to those referred to as heteronuclear J spectra in liquids are obtained for solids by a two-dimensional NMR technique exploiting the scalar coupling between nuclear spins. Chemical shifts are displayed along one frequency axis, and scalar couplings are displayed along a perpendicular axis. A spectrum of polycrystalline camphor is shown, with good resolution of the carbons. To obtain such spectra, the sample is spun at the magic angle, followed by carbon transverse magnetization. Multipulse decoupling is then done so that the carbon magnetization evolves with scalar coupling but dipolar interactions are suppressed. Switching to continuous proton irradiation then removes the effect of scalar coupling as well. Fourier transformation of the digitized data gives the final spectrum.

13895 **Electron mobility calculations in liquid xenon by the method of partial waves.** Vertes, A. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **88**: No. 17, 3722-3726(1984).

The method of partial waves in the framework of the fluctuation model has been applied to describe the density dependence of the electron mobility in liquid xenon. The limiting factor in the transport of excess electrons in such systems can be attributed to their scattering due to density fluctuations. Instead of the usual Born approximation we handled the scattering problem with the more general method of partial waves. This made it possible to work out the average fluctuation size from the transport data. Calculations were carried out in the density range (6.7-11.5) x 10^{21} atoms/cm^3. Good agreement with measured mobility curves can be obtained by considering reasonable values for the average fluctuation size.

13896 **Sulfur isotope separation by distillation.** Mills, T.R. (Los Alamos National Lab., NM). pp 409-410 of Synthesis and applications of isotopically labeled compounds. Duncan, W.P.; Susan, A.B. (eds.). Amsterdam, Netherlands; Elsevier Scientific Publishing Company (1983).

From International symposium; Kansas City, MO, USA (6-11 Jun 1982).

Sulfur isotope separation by low temperature distillation of hydrogen sulfide was studied in an 8 m, 25-mm diameter distillation column. Column temperature was controlled by a propane-propylene heat pipe. Column packing HETP was measured using nitric oxide in the column. The column was operated at pressures from 45 to 125 kPa. The relative volatility of S-32 vs. S-34 varied from 1.0008 to 1.0014. 5 references, 1 table.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 13571, 13783

13897 **(UCRL—94810) The plating solution and the human body: Complex electrochemical systems.** Dini, J.W. (Lawrence Livermore National Lab., CA (USA)). 18 Jun 1986. Contract W-7405-ENG-48. 19p. (CONF-8606251—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002684.

From American Electroplaters Society Foundation surface/finishing '86; Philadelphia, PA, USA (23 Jun 1986).

A thesis proposed is that a plating solution is much like the human body. The body is nothing more than a gigantic complex of molecules and chemicals working together in harmony - so is a plating solution.

13898 **Photoelectrocatalysis with composite electrodes of phthalocyanine and its metal derivatives.** Danginis, V.; Levine, S.N.; Linkous, C.A. (Dept. of Materials Science, State Univ. of New York at Stony Brook, Stony Brook, NY 11794). pp 418 of Proceedings of the 1986 Spring meeting of the Electrochemical Society. Pennington, NJ; The Electrochemical Society (1986). (CONF-860540—).

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

This paper discusses experiments performed using photoelectrocatalysis with composite electrodes of phthalocyanine and its metal derivatives. A wide variety of voltammetric results were obtained, depending on the thickness of the H/sub 2/Pc and MPc films, their morphology, their porosity, and whether they were sequentially or simultaneously deposited. At the least, the results differed from the use of either component alone. Results were interpreted according to various models, considering the MPc to be either an interband impurity state, a surface state, or a distinct organometallic phase in its own right, according to the electrode configuration.

4005 Photochemistry

REFER ALSO TO CITATION(S) 13893, 13898, 13906, 13907, 13908, 14607, 15132

13899 **Photosensitized reaction of ^3P Hg, Cd, and Zn atoms with diffluorochloroethene in krypton matrix.** Cartland, H.E.; Pimentel, G.C. (Univ. of California, Berkeley). *Journal of Physical Chemistry;* 90: No. 9, 1822-1827(24 Apr 1986). Contract AC03-76SF00098.

The reaction between M(^{3}P) atoms (M = Hg, Cd, Zn) with difluorochloroethene (CDFE) and deuteriodifluorochloroethene (CDFE-d) in krypton matrix at 12 K has been studied. The usual gas-phase reaction caused by mercury-photosensitization of halogenated ethenes, elimination of HX (or H_2), is not observed. Instead, each of these class IIB (group 12 in the new notation) metal atoms gives a reaction product with an absorption spectrum that resembles that of the parent olefin but shifted significantly to lower frequencies. For mercury, the product is identified as 1,1-difuorovinylmercuric chloride, (F_2C=CH) HgCl, the net result of mercury insertion into the carbon chlorine bond. Cadmium and zinc apparently give analogous products. The preferential insertion into the C-Cl bond indicates that reaction is constrained in krypton matrix to a triplet reaction surface and suggests that there is an activation energy barrier connected with the change in shape of the olefin in its planar, ground state to the twisted triplet state. The reactivity of the Hg(^{3}P) state relative to that of the ground state is attributed to its partially occupied valence orbitals. In view of the infrared spectrum of CDFE-d, the vibrational assignment deduced earlier for CDFE must be altered. 21 references, 4 figures, 4 tables.

13900 **Intramolecular processes in isolated polyatomic molecules.** Levy, M.R.; Mangir, M.S.; Renlund, A.M.; Watson, T.A. (Exxon Research, Linden, NJ). pp 35-58 of Energy storage and redistribution in molecules. Hinze, J. New York, NY; Plenum Press (1986). (CONF-8006137—).

From Workshop on molecular structure, rigidity, and energy surfaces and on energy scrambling in a molecule; Bielfeld, F.R. Germany (23 Jun 1980).

This paper discusses well known unimolecular processes which occur in isolated polyatomic molecules: chemical reactions, forming fragments with identifiable internal and translational energy distributions, and the coupling of vibrational and electronic degrees of freedom - a phenomenon which is responsible for so-called radiationless transitions. The work described is mainly experimental, and capitalizes on the fact that infrared lasers can be used to excite the vibrations of polyatomiscs in the absence of collisions. Two distinct experiments are described which deal with vibration-electronic coupling, and with laser driven unimolecular reactions of polyatomics.

13901 **Fully resonant four-wave mixing spectroscopy of pentacene and dye molecules in condensed phases.** Chang, T.C. Ames, IA; Iowa State Univ. (1985). 182p. University Microfilms Order No. 85-24,641.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Four-wave mixing spectroscopy (FWM) including coherent antistokes Raman spectroscopy (CARS) and coherent stokes Raman spectroscopy (CSRS) have been studied for pentacene doped in naphthalene crystals at low temperatures (4.5 to 35 K) in order to investigate nonlinear optical behavior of the third-order nonlinear susceptibility, X/sup (3)/. Further, its application to study of cresyl violet perchlorate embedded in polyacrylic acid and in polyvinyl carbazole has been examined. The theoretical basis for line narrowing has been established for fully resonant four wave mixing for a four-level system. A careful line-narrowing study for the pentacene 755 cm^{-1} resonance in naphthalene illustrates that line narrowing is operative. Temperature dependent studies indicate that the excited state population mechanism for negative detuning involves phonon hotband absorption. Power broadening data are discussed in terms of dynamic Stark shifts resulting from the site inhomogeneous line broadening of vibronic transitions. Cresyl violet perchlorate in polyacrylic acid shows that the CARS intensity of the excited state resonance at 585 cm^{-1} depends on the location of the omega$_1$-field within the severely inhomogeneously broadened absorption profile of the dye. It is argued that the linear electron-phonon interaction is an important mechanism for the intensity of the excited state resonance.

13902 **Nonlinear polariton effects in naphthalene.** Stevenson, S.H. Ames, IA; Iowa State Univ. (1985). 221p. University Microfilms Order No. 85-24,697.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Resonant second harmonic generation (SHG) and two-photon excited emission (TPE) were studied in pure, strain-free crystals of naphthalene at frequencies near that of the (0,0) a-exciton in order to probe the relationship between the two signals and to investigate the effect of polariton states on second order nonlinearities in molecular crystals. The strong coupling of the 31473 cm^{-1} exciton in naphthalene to the photon field dictates the second-order nonlinear behavior of naphthalene crystals at frequencies near half-resonance. The dynamics of polaritons produced coherently via nonlinear interactions is shown to deviate in a controllable way from the dynamics of the one-photon polaritons produced in a linear experiment. The nature of the excitation remains principally that of an exciton. The necessity of using a strong coupling model to explain orientational dispersion and intensity and lineshape behavior is established. The experimental angular frequency dispersion of the SHG and TPE signals are fit to theoretical polariton dispersion curves. The orientation of the naphthalene optical indicatrix at 31475 cm^{-1} is shown to be very nearly the same as that reported for visible light. The temperature dependences of the SHG and TPE signal intensities are successfully predicted from the polariton fusion model by inclusion of temporal damping in the fusion rate expression. The shapes of the SHG and TPE profiles are compared to shapes predicted from the semi-classical theory.

13903 **Multiphoton ionization and excitation of fluoranthene and benzene in solution.** Faidas, H.; Siomos, K.; Christophorou, L.G. (Oak Ridge National Lab., Oak Ridge, TN). pp vp. of Technical digest of ICALEO, 84. Toledo, OH; Laser Institute of America (1984). (CONF-8411100—).

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

The authors report on MPI and two-photon excitation (TPE) studies of fluoranthene (F) and benzene (B) in dilute solutions (≈10/sup -3/ to 10/sup -6/ M) of n-pentane (n-pt) at room temperature. The experimental apparatus employed is shown schematically. A nitrogen laser pumped-dye laser was used for both the ionization and the fluorescence experiments. Polarization optics allowed the use of either circularly or linearly polarized light. Both the photoionization and fluorescence signals were sampled by boxcar integrators and analyzed by a PDP-10 computer. The individual spectra were corrected for the intensity variations of the dye laser before they were combined in their respective regions of overlap.

13904 **Adiabatic approach in the theory of polyatomic photodissociation: application to C_2N_2.** Lester, W.A. Jr.; Kresin, V.Z.; Dateo, C.E. (Univ. of California, Berkeley). *Proceedings of the International Conference on Lasers;* 499-507(1984). Contract AC03-76SF00098.

An adiabatic method for nuclear motion has been developed and applied to single-photon predissociation of C_2N_2 (C tilde ^{1}PI/sub u/). The theoretical predictions are in good accord with recent measured product energy distributions. 15 references, 1 figure.

4006 Radiation Chemistry

13905 (N—87-10612, pp vp) **Radiative processes.** Frederick, J.E.; Leovy, C.; Anderson, D.E.,JR.; Anderson, G.P.; Dickinson, R.E.; Drayson, S.R.; Fels, S.; Hall, L.A.; Kiehl, J.; Mentall, J.E. 1985. NTIS, PC A22/MF A01. (NASA-TM—89237; NAS—1.15:89237).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change. Volume 1.

Solar radiation and the processes that control its deposition in the Earth atmosphere are considered. The published data obtained since 1978 define a reference solar spectral irradiance for use

in atmospheric chemical and dynamical studies, while long term satellite measurements are now providing information on variations in the output of the Sun over a range of time scales. As concerns absorption of solar radiation in the atmosphere, new cross section data for molecular oxygen and ozone are now available. Line-by-line calculations used to predict infrared flux divergences, both as regards assumptions made in radiative transfer calculations and in the spectroscopic parameters used as inputs are examined. Also examined are the influence of radiative processes on planetary scale wave activity, photochemical acceleration of radiative damping, and the breakdown of local thermodynamic equilibrium at mesospheric altitudes.

13906 **(PB—87-105938/XAB) Biweekly list of papers on radiation chemistry and photochemistry. Annual cumulation with keyword and author indexes. Volume 16. 1983.** Carmichael, I.C.; Helman, W.P.; Hug, G.L.; Ross, A.B. (Notre Dame Univ., IN (USA). Radiation Chemistry Data Center). 1983. 452p. NTIS, PC A20/MF A01.

The Biweekly List of Papers on Radiation Chemistry and Photochemistry is a current-awareness service published by the Radiation Chemistry Data Center (RCDC), with special emphasis on the kinetics and other properties of transient ions, radicals, and excited species. Papers are included on the radiation chemistry and photochemistry of organic and inorganic systems, biological molecules and polymers, with references to ESR and luminescence studies. Complete coverage is attempted only for those studies which are initiated by light or ionizing radiation, and which provide quantitative physical chemical data such as quantum yields, specific rates, G values, etc. No attempt is made to cover topics such as mechanistic and preparative photochemistry, photosynthesis, photography, and irradiation of metals. The references listed herein are obtained from scanning about 60 current journals as well as Chemical Abstracts, INIS Atomindex and several other publications listing current references. The reference lists, which are issued biweekly, are cumulated annually with the addition of keyword and author indexes. Indexed cumulations were published semiannually for Vol. 4-6 (1971-73) and are published annually for Vol. 7+ (1974+); back copies are available from the National Technical Information Service (NTIS).

13907 **(PB—87-105946/XAB) Biweekly list of papers on radiation chemistry and photochemistry. Annual cumulation with keyword and author indexes. Volume 17. 1984.** Carmichael, I.C.; Hug, G.L.; Helman, W.P.; Ross, A.B. (Notre Dame Univ., IN (USA). Radiation Chemistry Data Center). 1984. 457p. NTIS, PC A20/MF A01.

The Biweekly List of Papers on Radiation Chemistry and Photochemistry is a current-awareness service published by the Radiation Chemistry Data Center (RCDC), with special emphasis on the kinetics and other properties of translent ions, radicals, and excited species. Papers are included on the radiation chemistry and photochemistry of organic and inorganic systems, biological molecules and polymers, with references to ESR and luminescence studies. Complete coverage is attempted only for those studies which are initiated by light or ionizing radiation, and which provide quantitative physical chemical data such as quantum yields, specific rates, G values, etc. No attempt is made to cover topics such as mechanistic and preparative photochemistry, photosynthesis, photography, and irradiation of metals. The references listed herein are obtained from scanning about 60 current journals as well as Chemical Abstracts, INIS Atomindex, and several other publications listing current references.

13908 **(PB—87-105953/XAB) Biweekly list of papers on radiation chemistry and photochemistry. Annual cumulation with keyword and author indexes. Volume 18. 1985.** Carmichael, I.C.; Hug, G.L.; Helman, W.P.; Ross, A.B. (Notre Dame Univ., IN (USA). Radiation Chemistry Data Center). 1985. 498p. NTIS, PC A21/MF A01.

The Biweekly List of Papers on Radiation Chemistry and Photochemistry is a current-awareness service published by the Radiation Chemistry Data Center (RCDC), with special emphasis on the kinetics and other properties of transient ions, radicals, and excited species. Papers are included on the radiation chemistry and photochemistry of organic and inorganic systems, biological molecules and polymers, with references to ESR and luminescence studies. Complete coverage is attempted only for those studies which are initiated by light or ionizing radiation, and which provide quantitative physical chemical data such as quantum yields, specific rates, G values, etc. No attempt is made to cover topics such as mechanistic and preparative photochemistry, photosynthesis, photography, and irradiation of metals. The references listed herein are obtained from scanning about 60 current journals as well as Chemical Abstracts, INIS Atomindex, and several other publications listing current references.

13909 **(PB—87-140232/XAB) Technical activities 1986, Center for Radiation Research.** Kuyatt, C.E. (National Bureau of Standards, Washington, DC (USA). Center for Analytical Chemistry). Nov 1986. 313p. (NBSIR—86/3441). NTIS, PC A14/MF A01.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1986 in the NBS Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 13308, 13518

13910 **(DOE/ER/60432—4) Physical processes important to airborne radioactivity in an enclosed environment: Progress report.** Schery, S.D. (New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Physics). 12 Nov 1986. Contract FG04-86ER60432. 4p. NTIS, PC A02/MF A01. File Number DE87004493.

Work continues on assembling our automated two filter thoron/radon system. The mechanical components have been built and are being tested. The micro-computer control circuit has been designed. Both the Pylon thoron source and aerosol generator are being tested. 11 refs.

13911 **Evaluation of potential adsorbents for the /sup 191/Os//sup 191m/Ir radionuclide generator system.** Brihaye, C.; Butler, T.A.; Knapp, F.F. Jr. (Nuclear Medicine Group, Oak Ridge National Lab., Oak Ridge, TN). *Journal of Nuclear Medicine;* **25**: No. 5, 118(1984). (CONF-840619—). Contract W-7405-ENG-26.

From 31. annual meeting of the Society of Nuclear Medicine; Los Angeles, CA, USA (5 Jun 1984).

A systematic evaluation of adsorbents for potential use in the /sup 191/Os//sup 191m/Ir medical radionuclide generator included 39 inorganic materials broadly classified as a. oxides (9), b. antimonates (7), c. ferro-ferricyanides (8), d. phosphates (6), e. sulfides (3), f. and other materials (6), including the organic anion-exchanger AGMP-1. The goal of these studies was to develop a new generator system that will have a long useful shelf-life, good iridium-191m yields, low osmium-191 breakthrough and eliminate the need for a scavenger column. The uptake of /sup 190/Os in oxidation states (VI), potassium osmate, K/sub 2/[OsO/sub 2/(OH)/sub 4/]; (IV), potassium-hexachloroosmate, K/sub 2/OsCl/sub 6/; and (III), hexathiocyanoosmate, K/sub 3/Os(SCN)/sub 6/, was measured. The adsorbents having a high /sup 191/Os uptake were evaluated for /sup 191m/Ir elution yield using three physiologically compatible eluents. Although many exchangers showed good Os(III), (IV) or (VI) uptake in the "batch" equilibration studies, they showed only low /sup 191m/Ir elution yields. Only AGMP-1 showed significant /sup 191m/Ir elution yields under the test conditions. Research sponsored by the Office of Heallth and Environmental Research, US Department of Energy, under contract W-7405-ENG-26 with the Union Carbide Corporation.

13912 **Production of Mg-28 for medical applications by spallation.** Mausner, L.F.; Prach, T.; Ku, T.; Richards, P. (Brookhaven National Lab., Upton, NY). *Journal of Nuclear Medicine;* **25**: No. 5, 120(1984). (CONF-840619—).

From 31. annual meeting of the Society of Nuclear Medicine; Los Angeles, CA, USA (5 Jun 1984).

Magnesium-28 is the only radioactive isotope of magnesium with a half-life long enough to be useful as a tracer. It is utilized in studies of cell growth and reproduction, tumorigenicity, immunological surveillance, hormone regulation, and nutrition. It has been produced at BNL in the past at the graphite reactor by the two-step reaction Li-6 (n,t)α; Mg-26(t,p)Mg-28 and later directly with Mg-26 irradiated by 3.4 MeV tritons from a Van de Graaff accelerator. However, much higher specific activity is attainable at the BLIP facility with proton spallation reactions. KCl has been chosen as the target material because it is inexpensive, easily dissolved, and spallation on both K and Cl can give Mg-28. The KCl target is a 25 g pressed pellet 0.8 cm thick encapasulated in a stainless steel container and is typically irradiated over a weekend at 191 MeV. After irradiation, the pellet is dissolved in water containing Mg and Be carriers. This Be is precipitated by the addition of a pH 10 buffer solution. Then, other metal impurity ions are extracted from the filtrate by adding sodium tartrate and 8-hydroxyquinoline in chloroform and discarding the organic phase. Magnesium-28 is extracted from the KCl solution by mixing with portions of 0.1% oxine in chloroform and n-butylamine. Finally, the organic phase is destroyed with nitric acid and peroxide, and the product is dissolved in pH 4 saline. The overall chemical yield is 93%. The typical saturation activity at EOB is 4.9 mCi with a thick target yield of 5.1 μCi/μAh. The specific activity at EOB is 98 μCi/μg compared to 0.4 μCi/μg from the (t,p) reaction. The radiopurity of the spallation product is excellent, with no impurity gamma emitters detected at the limit of sensitivity (<0.1%).

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 13821, 13887, 15233

13913 **(N—87-10187) Numerical study of hydrogen-air supersonic combustion by using elliptic and parabolized equations. Progress report, 1 December 1985-31 May 1986.** Chitsomboon, T.; Tiwari, S.N. (Old Dominion Univ., Norfolk, VA (USA)). Aug 1986. 115p. (NASA-CR—179800; NAS—1.26:179800). NTIS, PC A06/MF A01.

The two-dimensional Navier-Stokes and species continuity equations are used to investigate supersonic chemically reacting flow problems which are related to scramjet-engine configurations. A global two-step finite-rate chemistry model is employed to represent the hydrogen-air combustion in the flow. An algebraic turbulent model is adopted for turbulent flow calculations. The explicit unsplit MacCormack finite-difference algorithm is used to develop a computer program suitable for a vector processing computer. The computer program developed is then used to integrate the system of the governing equations in time until convergence is attained. The chemistry source terms in the species continuity equations are evaluated implicitly to alleviate stiffness associated with fast chemical reactions. The problems solved by the elliptic code are re-investigated by using a set of two-dimensional parabolized Navier-Stokes and species equations. A linearized fully-coupled fully-implicit finite difference algorithm is used to develop a second computer code which solves the governing equations by marching in spce rather than time, resulting in a considerable saving in computer resources. Results obtained by using the parabolized formulation are compared with the results obtained by using the fully-elliptic equations. The comparisons indicate fairly good agreement of the results of the two formulations.

13914 **Response of a pulse combustor to changes in fuel composition.** Keller, J.O.; Westbrook, C.K. (Sandia National Labs.). pp 70 of Proceedings of the 21st symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

The response of a valved pulse combustor to changes in the homogeneous chemical ignition delay time has been examined. Guided by detailed chemical kinetic modeling, experiments were performed which measured the response of this combustor using two fuels having significantly different ignition delay times. It was found that differences in the reaction kinetics of the fuel caused changes in the coupling between the heat release and the resonant acoustic waves which control the pulsating combustion process. Furthermore, the change in this coupling caused corresponding changes in the fuel and air injection processes, hence, the strength of the resonant pressure wave. This complicated interaction resulted in a modification of the combustor's lean stability limit which was contrary to predictions based on chemical kinetics arguments alone.

13915 **Modification of solid propellant deflagration rates due to random nonhomogeneities.** Armstrong, R.C.; Margolis, S.B. (Sandia National Labs.). pp 43 of Proceedings of the 21st symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

A nonlinear response theory is employed to obtain the modification of the mean burning rate of a nonhomogeneous solid propellant. Although the methods used here are quite general, attention is focused on the interaction between the three-dimensional structure of the deflagration and the constitutive model. Based on a calculation of the mean burning rate as a function of the correlation length of a random nonhomogeneity, it is shown that the mean burning rate is greater than that of homogeneous burning for small correlation lengths, and is less for larger correlation lengths. Thus, this study indicates that a solid composed of particles of two different propellants would burn more slowly than their mean rate if the size of the particles were large, and more quickly if their size were small. As many of the methods used here are new to this application, some comment is also made on the utility of this approach in computing mean burning rate statistics for random media.

13916 **The reaction of atomic hydrogen and muonium with acetylene.** Duchovic, R.J.; Wagner, A.F.; Garner, D.M.; Fleming, D.G. (Chemistry Div., Argonne National Lab., Argonne, IL 60439). pp 191 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

A novel test of this hypothesis is to study the addition of muonium (Mu) to acetylene, currently being investigated at TRIUMF. Muonium is like a hydrogen atom but with a positive muon substituted for the proton. Muonium can be created with aligned nuclear spins.

13917 **Kinetic paths to equilibrium.** Creighton, J.R. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 189 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—). Contract W-7405-ENG-48.

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Analysis of numerical solutions of selected simple chemical kinetics mechanisms shows that the path from the initial state to equilibrium involves steady states which successively eliminate degrees of freedom. The kinetics mechanisms used bi-directional reaction steps representing single molecular collisions. The systems modeled were spatially uniform and closed at constant pressure. Both adiabatic systems and those with heat loss were considered.

13918 **An HTP kinetics study of the reaction of O(/sup 3/P) atoms with ethylene from 300 to 1500 K.** Mahmud, K.; Fontijn, A. (Dept. of Chemical Engineering and Environmental Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180-3590). pp 138 of Proceedings of the twenty-first symposium (international) on combustion. Pittsburgh, PA; Combustion Institute (1986). (CONF-860804—).

From 21. international symposium on combustion; Munich, F.R. Germany (3 Aug 1986).

Kinetic data on isolated elementary reactions covering wide temperature ranges and obtained in one apparatus are rare. Yet, such data are much needed to help arrive at a reliable experimental data base for use by combustion modellers and theoretical kineti-

cists. A high-temperature photochemistry (HTP) reactor is used in the current work to obtain kinetic data in the 300-1800 K range for reactions of ground-state O atoms with hydrocarbons.

42 ENGINEERING

REFER ALSO TO CITATION(S) 15233

13919 **(INIS-mf—10094) Order of 27 February 1985 setting up a Nuclear Engineering Terminology Commission.** (International Atomic Energy Agency, Vienna (Austria)). 6 Mar 1985. 1p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780526.

The Commission set up by this Order will draw up an inventory of the gaps in French nuclear engineering vocabulary, taking into account users' needs; it will also propose and revise the necessary terms in the light of present knowledge and contribute to collection and harmonization of terminological and neological data.

13920 **(UCID—20366-87) Engineering thrust areas, 1987.** (Lawrence Livermore National Lab., CA (USA)). 1987. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004443.

This booklet contains descriptions of the activities of each thrust area and illustrates how thrust area innovations and advanced technologies support laboratory programs. The thrust areas are concerned with: computer code development; computer technologies; diagnostics and microelectronics engineering, dynamic systems and control; engineering modeling and simulation; fabrication technology; materials engineering; microwave and pulsed power; non-destructive evaluation; and remote sensing, image and signal engineering.

13921 **(Y/PG—3117) CIM [computer-integrated manufacturing]: It all starts with product definition.** Stephens, A.E. (Oak Ridge Y-12 Plant, TN (USA)). 29 Dec 1986. Contract AC05-84OS21400. 16p. (CONF-870242—1). NTIS, PC A02/MF A01. File Number DE87004198.

From Automation Technology Institute conference; Monterey, CA, USA (10 Feb 1987).

The logical starting place for computer-integrated manufacturing (CIM) is at the front end of the production process - product definition. It consists of the part/assembly drawings, material lists, specifications, and procedures. Product definition starts at the design agencies: two nuclear design laboratories (Los Alamos National Laboratory and Lawrence Livermore National Laboratory) and a non-nuclear design laboratory (Sandia National Laboratories with two site locations). These laboratories perform the basic part design which is then transferred over a secure communications network to the Oak Ridge Y-12 Plant, where weapon components are produced by Martin Marietta Energy Systems, Inc., under contract with the Department of Energy (DOE). Initial Graphics Exchange Specifications (IGES) and DOE Data Exchange Format (DOEDEF) translation software is used to transfer part designs between dissimilar graphics systems. Product-definition data flow is examined both external and internal to the Y-12 Plant. Software developed specifically to computerize product definition is covered as follows: Electronic File Manager (EFM), Manage Design Documents, Distribute Product Definition, Manage Manufacturing Procedures and Product Specifications. Trident II is the first program to beneficially use CIM technologies plant-wide. Prototype software was written to add a layer of user friendliness through multilayer menu selects to enable access to a number of existing application software packages. Additional software was developed and purchased that enables a single personal computer to meet many needs. These product-definition needs include procedures generation, graphics viewing, and office automation. 3 figs.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 13238, 13239, 13240, 13243, 13244, 13245, 13246, 13247, 13248, 13249, 13301, 13333, 13483, 13703, 13704, 13706, 13707, 13708, 13710, 13711, 13712, 14390, 14477, 15249

13922 **(AD-A—173193/4/XAB) Nine-size system for chemical defense gloves. Technical report.** Robinette, K.M.; Annis, J.F. (Anthropology Research Project, Inc., Yellow Springs, OH (USA)). Jul 1986. 44p. NTIS, PC A03/MF A01.

The purpose of this effort was to meet the need for improved sizing of chemical defense gloves for Air Force men and women. A nine-size system was developed from available hand data. The development process and size values are presented in this report. Some summary statistics and regression equations are provided to aid investigators who may wish to make modifications. Although the anthropometric sizing system outlined in this report is statistically sound, it is experimental. The authors recommend that anthropometric fit-testing be conducted prior to full-scale glove production.

13923 **(AD-A—173545/5/XAB) Dexterity testing of chemical-defense gloves. Technical report.** Robinette, K.M.; Ervin; Zehner, G.F. (Anthropology Research Project, Inc., Yellow Springs, OH (USA)). May 1986. 36p. NTIS, PC A03/MF A01.

Chemical-defense gloves (12.5-mil Epichlorohydron/Butyl, 14-mil Epichlorohydron/Butyl, and 7-mil Butyl with Nomex overgloves) were subjected to four dexterity tests (O'Connor Finger Dexterity Test, Pennsylvania Bi-Manual Worksample-Assembly, Minnesota Rate of Manipulation Turning, and the Crawford Small Test). Results indicated that subjects performances were most impaired by the 7-mil Butyl with Nomex overglove. Though differences between the other three gloved conditions were not always statistically significant, subjects performed silghtly better while wearing the Epichlorohydron/Butyl gloves, no matter which thickness, than they did while wearing the 15-mil butyl gloves. High negative correlation between anthropometry and gloved tests scores of subjects suggested that poor glove fit may also have affected subjects performances.

13924 **(AD-A—173693/3/XAB) Factors influencing the sustained-performance capabilities of 155-mm howitzer sections in simulated conventional and chemical warfare environments. Technical report.** Rauch, T.M.; Banderet, L.E.; Tharion, W.J.; Munro, I.; Lussier, A.R. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). Apr 1986. 35p. (USARIEM-T—11/86). NTIS, PC A03/MF A01.

Factors that limit the performance capabilities of sustained artillery operations in simulated conventional and chemical warfare environments were studied. The results show that perceptions of psychological (mental) fatigue, rather than perceptions of muscular fatigue, were primary factors affecting sustained artillery performance. Furthermore, variations in these psychological states were correlated with artillery task performance during the period. In the simulated chemical warfare environment, extreme symptom and mood changes resulted in medical casualties, combat ineffectiveness, and early termination of all testing. Significant perosnality differences existed between casualties and survivors. The majority of casualties voluntarily terminated operational duties because of intense symptoms associated with wearing the chemical protective mask and clothing system. These symptoms were manifestations of respiratory and thermal stress.

13925 **(AD-A—173929/1/XAB) Analysis of wartime consumption rates for chemical defensive equipment. Volume 2. Appendices A, B, and C, documentation. Contributing analysis.** Christenson, W.M.; Kerlin, E.P. (Institute for Defense Analyses, Alexandria, VA (USA)). May 1986. 126p. (IDA-P—1851-VOL-2). NTIS, PC A07/MF A01.

The objective of the analysis was to provide a comprehensive evaluation of wartime consumption rates for chemical-warfare (CW) defensive material for use in developing war reserve requirements and assessing the current US stockpile. The study presents, in

Volume I, a comprehensive discussion of the efforts undertaken to compute the wartime consumption rates for chemical-warfare defensive equipment (CDE) using IDA TACWAR model. Volume II, Documentation, comprises Appendices A, B and C. Appendix A details how division, corps, and theater army support forces were aggregated to provide functional support units as input to the TACWAR model. Appendix B contains a discussion of the decision rules that were developed by the U.S. Army Chemical School for use in the analysis. Appendix C presents the details of the post-processor which was developed to manipulate output data from the TACWAR model and generates consumption rates for each CDE item. Appendix D, which is presented as Volume III, contains the actual consumption rates for the CDE items which form the detailed output of this study.

13926 **(AD-A—173930/9/XAB) Analysis of wartime consumption rates for chemical defensive equipment. Volume 3. Appendix D. Post-processor data. Contributing analysis.** Christenson, W.M.; Kerlin, E.P. (Institute for Defense Analyses, Alexandria, VA (USA)). May 1986. 337p. (IDA-P—1851-VOL-3). NTIS, PC A15/MF A01.

The objective of the analysis was to provide a comprehensive evaluation of wartime consumption rates for chemical-warfare (CW) defensive material for use in developing war reserve requirements and assessing the current US stockpile. The study presents, in Volume I, a comprehensive discussion of the efforts undertaken to compute the wartime consumption rates for chemical-warfare defensive equipment (CDE) using the IDA TACWAR model. Volume II, Documentation, comprises Appendices A, B and C. Appendix A details how division, corps, and theater army support forces were aggregated to provide functional support units as input to the TACWAR model. Appendix B contains a discussion of the decision rules that were developed by the U.S. Army Chemical School for use in the analysis. Appendix C presents the details of the post-processor which was developed to manipulate output data from the TACWAR model and generates consumption rates for each CDE item. Appendix D, which is presented as Volume III, contains the actual consumption rates for the CDE items which form the detailed output of this study.

13927 **(AD-A—174273/3/XAB) Psychological factors that limit the endurance capabilities of armor crews operating in a simulated NBC environment. Technical report, July 1985-May 1986.** Tharion, W.J.; Rauch, T.M.; Munro, I.; Lussier, A.R.; Banderet, L.E. (Army Research Inst. of Environmental Medicine, Natick, MA (USA)). May 1986. 42p. (USARIEM-T—14/86). NTIS, PC A03/MF A01.

Factors which limit the performance capabilities of sustained armor operations in simulated conventional- and chemical-warfare environments were studied. In the simulated chemical-warfare environment, extreme symptom and mood changes resulted in medical casualties, combat ineffectiveness, and early termination of all testing. Significant personality differences existed between casualties and survivors. The majority of casualties voluntarily terminated operational duties because of intense symptoms associated with wearing the chemical protective mask and clothing system. These symptoms were manifestations of respiratory and thermal stress.

13928 **(DOE/CE/15295—T2) [Prototype development of downhole Pneumatic Turbine motor]: Quarterly technical report.** (Pneumatic Turbine Partnership, Santa Fe, NM (USA)). 31 Dec 1986. Contract FG01-86CE15295. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002497.

This report presents information on the development of a downhole pneumatic turbine motor. Areas of interest covered concern: fabrication of components; fabrication of the test stand; and bench testing of components.

13929 **(DP-MS—86-185) Development of a telerobotic system for handling contaminated process equipment.** Fisher, J.J.; Ward, C.R.; Schuler, T.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1987. Contract AC09-76SR00001. 9p. (CONF-870301—13). NTIS, PC A02/MF A01. File Number DE87004186.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

E. I. du Pont de Nemours and Company is evaluating a unique eight-degree-of-freedom Telerobot manipulator to perform size-reduction and material handling operations on contaminated process equipment at the Savannah River Plant (SRP). The Telerobot will be installed in the proposed Transuranic (TRU) Waste Processing Facility, which is scheduled to be operational by 1990. A full-scale prototype Telerobot, manufactured by GCA Corporation, St. Paul, MN is being tested with other process equipment in the Components Test Facility at the Savannah River Laboratory (SRL). All telerobotic operations required in the TRU Waste Facility such as crate unpacking, equipment dismantling, material size-reduction, and selected maintenance operations are being tested. This paper discusses the major mechanical and control features of the Telerobot system. Several system enhancements were added by SRL, including a new quick-hand-change coupling and expanded software control functions. The new software enables a system operator to perform both teleoperated and automatic tasks through several operating modes. These enhancements, as well as future mechanical, control system, and software features, are reviewed.

13930 **(DP-MS—86-192) Computer control of shielded cell operations.** Jeffords, W.R. III. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1987. Contract AC09-76SR00001. 6p. (CONF-870301—11). NTIS, PC A02/MF A01. File Number DE87004185.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

This paper describes in detail a computer system to remotely control shielded cell operations. System hardware, software, and design criteria are discussed. We have designed a computer-controlled buret that provides a tenfold improvement over the buret currently in service. A computer also automatically controls cell analyses, calibrations, and maintenance. This system improves conditions for the operators by providing a safer, more efficient working environment and is expandable for future growth and development.

13931 **(EPRI-CS—4925) Development and testing of equipment for removal of PCBs [polychlorinated biphenyls] from porous surfaces: Final report.** Gardner, H.R.; Bateman, D.B. (Quadrex HPS, Inc., Richland, WA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 62p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920152.

Cleanup of PCBs from materials such as concrete, brick, or asphalt typically involves removal of the contaminated area or manual scrubbing and mopping. This study shows that PCB removal by mechanical equipment can be as effective as manual cleaning, depending on the age and condition of the surface.

13932 **(HEDL-SA—3547-FP) Evaluation of glovebox sectioning using weld splitting techniques.** Titzler, P.A.; Allen, C.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 16 Nov 1986. Contract AC06-76FF02170. 14p. (CONF-861102—31). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004347.

From American Nuclear Society and Atomic Industrial Forum joint meeting; Washington, DC, USA (16 Nov 1986).

A weld splitting method is being evaluated for sectioning austenitic stainless steel components. Testing consists of sectioning simulated stainless steel gloveboxes into disposable pieces to determine the acceptability of using dissimilar metal weld splitting methods. The activities are being performed for the Savannah River Laboratory by Westinghouse Hanford Company (WHC) in Richland, Washington.

13933 **(LA-UR—86-3768) Automatic bagout system.** Whitaker, R.M. (Los Alamos National Lab., NM (USA)). Nov 1986. Contract W-7405-ENG-36. 8p. (CONF-870301—2). NTIS, PC A02. File Number DE87002922.

From International topical meeting on remote systems and robotics in hostile environments; Pasco, WA, USA (29 Mar 1987).

Nuclear material entrained wastes are generated at the Plutonium Facility at Los Alamos National Laboratory. These wastes are removed from the glove box lines using the bagout method. This is a manual operation performed by technicians. An automated

system is being developed to relieve the technicians from this task. The system will reduce the amount of accumulated radiation exposure to the worker. The primary components of the system consist of a six degree of freedom robot, a bag sealing device, and a small gantry robot. 1 ref., 5 figs.

13934 **(LBL—22431) Period three generation on microwave-induced constant-voltage steps of Josephson tunnel junctions.** Mygind, J.; Bindslev Hansen, J.; Clarke, J.; Ovsyannikov, G.A.; Svensmark, H. (Lawrence Berkeley Lab., CA (USA); Danmarks Tekniske Hoejskole, Lyngby. Fysisk Lab. 1). Oct 1986. Contract AC03-76SF00098. 6p. (CONF-860914—28). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003530.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

We report the observation of one-third harmonic generation in small Josephson tunnel junctions driven with a microwave signal in the frequency range 8 to 18 GHz. This phenomenon was observed both with the junction biased in the zero voltage state and on microwave-induced constant-voltage steps in the current-voltage characteristic. With high levels of applied microwave power the period-tripled signal was detected on steps up to order 120.

13935 **(N—87-10406) Taylor-Galerkin finite element algorithm for transient nonlinear thermal-structural analysis. Progress report, period ending 1 January 1986.** Thornton, E.A.; Dechaumphai, P. (Old Dominion Univ., Norfolk, VA (USA)). Apr 1986. 12p. (NASA-CR—177064; NAS—1.26:177064). NTIS, PC A02/MF A01.

A Taylor-Galerkin finite element method for solving large, nonlinear thermal-structural problems is presented. The algorithm is formulated for coupled transient and uncoupled quasistatic thermal-structural problems. Vectorizing strategies ensure computational efficiency. Two applications demonstrate the validity of the approach for analyzing transient and quasistatic thermal-structural problems.

13936 **(PB—87-116299/XAB) Superconducting accelerating resonator for very-low-velocity ions. Final report.** Delayen, J.R. (Applied Superconductivity, Inc., Altadena, CA (USA)). Aug 1984. 12p. NTIS, PC A02/MF A01.

The purpose of the research project was to investigate ways to reduce the sensitivity of the resonator eigenfrequency to external vibrations, and to use active electronic feedback to damp out these vibrations. The study of the interactions between the electromagnetic and mechanical modes of a low-beta accelerating structure was done from three directions: electronic control, electromagnetic design, and mechanical design. The outcome of the research indicates that a superconducting resonator for acceleration of heavy ions of very low velocity is technically feasible. Such a resonator would greatly increase the mass range of heavy-ion boosters.

13937 **(PB—87-125738/XAB) Metrology for electromagnetic technology: a bibliography of NBS (National Bureau of Standards) publications.** Kline, K.E.; DeWeese, M.E. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). Jun 1986. 57p. (NBSIR—86/3048). NTIS, PC A04/MF A01.

The Electromagnetic Technology Division was formed during the reorganization of NBS in April 1978 by combining parts of the former Electromagnetics and Cryogenics Divisions. It develops measurement methods and standards and provides metrological support for: laser systems; optical communication equipment; cryoelectronics; superconductors; and other unusual electrical engineering materials.

13938 **(SAND—86-1574C) A comparison of predicted and measured aeroheating on a reentry vehicle flap geometry.** Kuntz, D.W.; Polansky, G.F.; Buffington, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 13p. (CONF-870133—1; AIAA—87-0517). NTIS, PC A02/MF A01. File Number DE87004312.

From 25. AIAA aerospace sciences meeting; Reno, NV, USA (12 Jan 1987).

The purpose of this paper is to illustrate the applicability of two different techniques for predicting flap heating, and to compare the results of these techniques with wind tunnel data obtained on a flap model. The wind tunnel data was obtained in the Naval Surface Weapons Center's Tunnel 9 using an RV model equipped with six drag flaps. One flap and the RV surface surrounding the flap were instrumented with heat transfer gages to measure the heating distributions on the flap surface and side walls and on the surrounding RV surface. The two analytical techniques are related in that they both use an inviscid/boundary layer solution technique to predict aeroheating. The first and less sophisticated of these two techniques uses an inviscid/boundary layer program to predict the heating on the RV surface, as well as the Mach number distribution through the boundary layer and the rotational inviscid layer just upstream of the flap. The technique of Cassel and Jarrett, which makes use of two dimensional oblique shock wave relations, is then used with the predicted upstream Mach number distribution to predict the heating distribution on the flap surface and side walls. The second technique used to predict the flap heating uses an inviscid and boundary layer approach in which the complete RV and flap geometry is modeled. This technique is significantly more complicated than the first technique, and is capable of modeling the three dimensional aspects of the flowfield in the region of the flap. Thus this approach should produce significantly more accurate solutions than the technique of Cassel and Jarrett which is essentially two dimensional in nature.

13939 **Current noise measured in the dc SQUID.** Martinis, J.M.; Clarke, J. (Univ of California, Berkeley, CA). *Journal of Low Temperature Physics;* **65**: No. 5/6, 459-468(Dec 1986).

Measurements are presented of the current noise in a dc superconducting quantum interference device (SQUID) and of its correlation with the voltage noise across the SQUID. The measured spectral densities are in good agreement with analog simulations. When a resonant circuit is connected across the output of the SQUID, there is a reduction in the current noise for frequencies at which the impedance of the circuit is low. This effect is also in good agreement with predictions.

13940 **Three-dimensional analysis of a radiant furnace-application to nitric oxide decomposition.** Lyczkowski, R.W.; Wang, C.S.; Chow, L.S.H.; Johnson, T.R.; Berry, G.F. (Argonne National Lab., IL). *Journal of Propulsion and Power;* **2**: 457-464(Oct 1986).

The objectives of this investigation are to (1) analyze the three-dimensional steady-state fluid flow and temperature patterns in an experimental magnetohydrodynamics (MHD) radiant furnace; (2) use these results, together with a transient three-dimensional tracer simulation, to develop a one-dimensional temperature/flow model for characteristic residence times and temperatures; and (3) use this model to interpret experimental nitric oxide (NO) decomposition data. Calculated results from two three-dimensional thermal hydraulics computer programs indicate highly three-dimensional flow patterns. The high velocity gas stream entering the furnace from the diffuser hits the slag screen and flows downward, splitting into two characteristic flow paths: one close to the slag screen and one much further below it. The gas along these two flow paths then flows upward through the staggered tubes forming the lower section of the slag screen. 17 references.

13941 **Performance characteristics of gravity-assisted potassium heat pipes.** Prenger, F.C.; Keddy, E.S.; Sena, J.T. (Astronautics Technology Center, Madison, WI; Los Alamos National Lab., NM). *Journal of Spacecraft and Rockets;* **23**: 407-410(Aug 1986).

Experiments with potassium-stainless steel gravity-assisted heat pipes were performed. Performance limitations due to entrainment or flooding of the liquid return flow are compared with analytical model predictions. The effect of heated pool height was investigated, and problems with surface wetting are discussed. A comparison between entrainment limits for smoothand textured-walled heat pipes was made, and a minimum internal surface texturing depth is suggested.

13942 **(BG-Trans—15034) Development of underground radar system: 4th report.** Tanaka, H.; Matsuura, M.; Furusawa, H.; Suyama, K. (British Gas Corp., London; Tokyo Gas Research and Development Inst. (Japan)). 1986. Translated from 30th annual report of Tokyo Gas Research and Development Institute, pp 207-226. 35p. NTIS (US Sales Only), MF A01. File Number DE87900423.

Investigations have been carried out on the antenna and on the signal transmitting and receiving circuits which exert a major influence on the performance of the underground radar location system. Arising out of these, a novel antenna device has been developed and a Mark 4 prototype unit has been completed.

13943 **Lighting for remote viewing systems.** Draper, J.V. (Clarke Ambrose Inc., Knoxville, TN). pp 69-72 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—).

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

Scenes viewed by television do not provide the same channels of information for judgment of distances as scenes viewed directly, since television eliminates or degrades several depth perception cues. However, it may be possible to improve depth perception of televised scenes by enhancing the information available through depth cues that are available from lighting. A literature survey and expert opinions were integrated to design a remote lighting arrangement which could enhance depth perception of operators performing remote handling operations. This paper describes the lighting arrangement and discusses some of its advantages and disadvantages.

13944 **Dual arm master controller concept.** Kuban, D.P.; Perkins, G.S. (Engineering Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 433-436 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The Advanced Servomanipulator (ASM) slave was designed with an anthropomorphic stance, gear/torque tube power drives, and modular construction. These features resulted in increased inertia, friction, and backlash relative to tape-driven manipulators. Studies were performed which addressed the human factors design and performance trade-offs associated with the corresponding master controller best suited for the ASM. The results of these studies, as well as the conceptual design of the dual arm master controller, are presented.

13945 **Automatic camera tracking for remote manipulators.** Stoughton, R.S.; Martin, H.L.; Bentz, R.R. (The Univ. of Tennessee, Knoxville, TN 37916). pp 383-394 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—).

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The problem of automatic camera tracking of mobile objects is addressed with specific reference to remote manipulators and using either fixed or mobile cameras. The technique uses a kinematic approach employing 4 x 4 coordinate transformation matrices to solve for the needed camera PAN and TILT angles. No vision feedback systems are used, as the required input data are obtained entirely from position sensors from the manipulator and the camera-positioning system. All hardware requirements are generally satisfied by currently available remote manipulator systems with a supervisory computer. The system discussed here implements linear plus on/off ("bang-bang") closed-loop control with a +-2-deg deadband. The deadband area is desirable to avoid operator "seasickness" caused by continuous camera movement. Programming considerations for camera control, including operator interface options, are discussed. The example problem presented is based on an actual implementation using a PDP 11/34 computer, a TeleOperator System SM-229 manipulator, and an Oak Ridge National Laboratory (ORNL) camera-positioning system.

13946 **Control software architecture and operating modes of the Model M-2 maintenance system.** Satterlee, P.E. Jr.; Martin, H.L.; Herndon, J.N. (Instrumentation and Controls Div., Oak Ridge National Lab., Oak Ridge, TN 37831). pp 355-366 of Robotics and remote handling in hostile environments. LaGrange Park, IL; American Nuclear Society (1984). (CONF-840413—). Contract W-7405-ENG-26.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

The Model M-2 maintenance system is the first completely digitally controlled servomanipulator. The M-2 system allows dexterous operations to be performed remotely using bilateral force-reflecting master/slave techniques, and its integrated operator interface takes advantage of touch-screen-driven menus to allow selection of all possible operating modes. The control system hardware for this system has been described previously. This paper describes the architecture of the overall control system. The system's various modes of operation are identified, the software implementation of each is described, system diagnostic routines are described, and highlights of the computer-augmented operator interface are discussed.

4203 Lasers

REFER ALSO TO CITATION(S) 13204, 13756, 13794, 13903, 14058, 14871, 15139

13947 **(AD-A—172660/3/XAB) Intense excitation source of blue-green laser. Annual summary report, 1 October 1985-30 September 1986.** Han, K.S. (Hampton Univ., VA (USA). Dept. of Physics). 6 Oct 1986. 14p. NTIS, PC A02/MF A01.

An intense and efficient source for blue-green laser useful for the space-based satellite laser applications, underwater strategic communication, and measurement of ocean bottom profile is being developed. The source in use, the hypocycloidal pinch plasma (HCP), and the dense plasma focus (DPF) can produce intense uv photons (200-400nm) that match the absorption spectra of both near-uv and blue-green dye lasers (300-400nm). As a result of optimization of the DPF light at 355nm, the blue green dye (LD490) laser output exceeding 4mJ was obtained at the best cavity tunning of the laser system. With the HCP pumped system, a significant enhancement of the blue-green laser outputs with dye LD490 and coumarin 503 was achieved through the spectrum conversion of the pumping light by mixing a converter dye BBQ. The maximum increase of laser output with the dye mixture of LD490+BBQ and coumarin 503+BBQ was greater than 80%. In addition, the untuned near-uv lasers were also obtained. The near-uv laser output energy of P-terphenyl dye was 0.5mJ at lambda sub C=337nm with the bandwidth of 3nm for the pulse duration of 0.2us. Another near-uv laser output energy obtained with BBQ dye was 25 mJ at lambda/sub C/=383nm with the bandwidth of 3nm for the pulse duration of 0.2us. Another near uv laser output energy obtained with BBQ dye was 25 mJ at lambda/sub C/=383nm with the bandwidth of 3nm for the pulse duration of 0.2microsec.

13948 **(AD-A—172871/6/XAB) Spectroscopic and laser characterization of emerald. Final report, April 1983-April 1986.** Lai, S.T.; Chai, B.H. (Applied-Signal, Inc., Morristown, NJ (USA). Electronic Materials and Devices Lab.). Aug 1986. 67p. NTIS, PC A04/MF A01.

The spectroscopic characteristics and laser properties of emerald were investigated. The laser measurements showed that the emerald-laser tuning range was 720-842 nm and exhibited a high gain and high efficiency in the 760-790 nm range. Under a crystal growth development program, the laser loss was reduced from 11%/cm to 0.4%/cm. The limiting factor in the laser efficiency is the excited-state absorption (ESA). The ESA was measured by two methods: a laser-pumped single-pass gain method, which is generally applicable to all tunable laser materials, and a laser-pumped laser method. A 76% laser quantum yield was obtained in high-optical-quality emerald. The maximum yield is estimated to be 83%, based on the ESA measurements.

13949 (AD-A—172996/1/XAB) **Free-electron-laser theory. Final report No. 4, 1 May 1985-30 April 1986.** Colson, W.B. (Berkeley Research Associates, Inc., CA (USA)). 10 Jul 1986. 98p. (BRA—86-313R). NTIS, PC A05/MF A01.

Free electron laser (FEL) theory is extended to explain several effects associated with high-gain operation. The trapped-particle instability is reviewed for short-pulse FELs, FEL oscillators, and FEL amplifiers. A new FEL theory exactly includes the effect of an arbitrary electron distribution function, and an explanattion is given for optical self-guiding.

13950 (AD-A—173183/5/XAB) **Correlated emission laser - towards high-sensitivity ring-laser gyroscopes and wave detectors. Final report, 1 March 1985-31 May 1986.** Scully, M.O.; Pedrotti, L.M. (New Mexico Univ., Albuquerque (USA). Center for Advanced Studies). Sep 1986. 114p. NTIS, PC A06/MF A01.

In addition to this fundamental research in the nature of the noise present in a measurement of phase, and the consequent development of the CEL concept, research was carried out in a number of related topics. This includes acting as a theoretical support group for (now defunct) large, passive, resonant-ring gyroscope experimental effort at the Air Force Academy. In addition, a preliminary experimental RLG effort has begun at the University of New Mexico under the auspices of this contract. Finally, the authors studied in a somewhat general manner the quantum distribution functions. Techniques involved in this latter study are very useful in calculations of quantum noise.

13951 (AD-A—173725/3/XAB) **Electric-discharge coaxial-laser power measurement. Final report, 20 May-1 June 1985.** Augustoni, A.L. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Sep 1986. 28p. (AFWL-TN—85-46). NTIS, PC A03/MF A01.

This report presents a theoretical and empirical treatment of the power-measuring techniques used in determining the output power of the Electric Discharge Coaxial Laser (EDCL). Errors in power measurement associated with the diagnostic beam splitter were investigated. These areas included errors associated with the removal of the beam splitter for storage overnight and the repositioning of the beam splitter the following day, and the introduction of possible errors as a result of interference between the beams reflected from the front and rear surfaces of the beam splitter.

13952 (BNL—39049) **LEGS technical note 15: A ring-cavity for a quadrupled Nd-YAG laser.** Matone, G. (Brookhaven National Lab., Upton, NY (USA)). [1987]. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004175.

The important characteristics of the proposed storage-ring cavity for green light to be used in the quadrupling of Nd-YAG laser are discussed. These include the attainable infrared power densities, the expected ir-to-green and green-to-uv conversion efficiencies, and the equilibrium uv power levels analyzed assuming both rectangular and gaussian shaped pulses. This analysis demonstrates that in all cases, an equilibrium in the green power stored is very quickly achieved and average uv power levels of approximately 20 W are possible. 6 figs., 2 tabs.

13953 (DOE/ER/10979—14) **Intensity cross-correlation in stimulated Raman scattering.** Raymer, M.G.; Westling, L.A. (Rochester Univ., NY (USA). Inst. of Optics). 1986. Contract AC02-81ER10979. 3p. (CONF-860621—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004307.

From OSA/IEEE international quantum electronics conference (IQEE '86); San Francisco, CA, USA (9 Jun 1986).

The intensity cross-correlation function between a broadband pump laser and generated Stokes light has been measured by frequency mixing. A strong correlation has been found, whose magnitude varies with the collisional relaxation time of the Raman medium. 2 refs.

13954 (N—87-10263, pp vp) **Tunable solid-state laser technology for applications to scientific and technological experiments from space.** Allario, F.; Taylor, L.V. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8608134—).

From 13. international laser radar conference; Toronto, Canada (11 Aug 1986).

Current plans for the Earth Observing System (EOS) include development of a lidar facility to conduct scientific experiments from a polar orbiting platforms. A recommended set of experiments were scoped, which includes techniques of atmospheric backscatter (Lidar), Differential Absorption Lidar (DIAL), altimetry, and retroranging. Preliminary assessments of the resources (power, weight, volume) required by the Eos Lidar Facility were conducted. A research program in tunable solid state laser technology was developed, which includes laser materials development, modeling and experiments on the physics of solid state laser materials, and development of solid state laser transmitters with a strong focus on Eos scientific investigations. Some of the system studies that were conducted which highlight the payoff of solid state laser technology for the Eos scientific investigations will be discussed. Additionally, a summary of some promising research results which have recently emerged from the research program will be presented.

13955 (N—87-10263, pp vp) **Nd:Glass-Raman laser for water vapor dial.** Kagann, R.H.; Petheram, J.C.; Rosenberg, A. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8608134—).

From 13. international laser radar conference; Toronto, Canada (11 Aug 1986).

A tunable solid-state Raman shifted laser which was used in a water vapor Differential Absorption Lidar (DIAL) system at 9400 A is described. The DIAL transmitter is based on a tunable glass laser operating at 1.06 microns, a hydrogen Raman cell to shift the radiation to 1.88 microns, and a frequency doubling crystal. The results of measurements which characterize the output of the laser with respect to optimization of optical configuration and of Raman parameters were reported. The DIAL system was also described and preliminary atmospheric returns shown.

13956 (N—87-10263, pp vp) **High spectral purity, narrow linewidth laser transmitter for dial measurements.** Singh, U.N.; Flamant, P.H. (Laboratoire de Meteorologie Dynamique du CNRS, Palaiseau, France). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8608134—).

From 13. international laser radar conference; Toronto, Canada (11 Aug 1986).

A laser transmission with very high degree of spectral purity in described. Amplified Spontaneous Emission (ASE) dependence on the oscillator energy and detuning away from the gain curve center are demonstrated. The effects of both finite laser linewidth and spectral purity on humidity measurements are experimentally demonstrated.

13957 (N—87-10263, pp vp) **Time-resolved lidar fluorosensor for sea pollution detection.** Ferrario, A.; Pizzolati, P.L.; Zanzottera, E. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8608134—).

From 13. international laser radar conference; Toronto, Canada (11 Aug 1986).

A contemporary time and spectral analysis of oil fluorescence is useful for the detection and the characterization of oil spills on the sea surface. Nevertheless the fluorosensor lidars, which were realized up to now, have only partial capability to perform this double analysis. The main difficulties are the high resolution required (of the order of 1 nanosecond) and the complexity of the detection system for the recording of a two-dimensional matrix of data for each laser pulse. An airborne system whose major specifications were: time range, 30 to 75 ns; time resolution, 1 ns; spectral range, 350 to 700 nm; and spectral resolution, 10 nm was designed and constructed. The designed system of a short pulse ultraviolet laser source and a streak camera based detector are described.

13958 (N—87-10263, pp vp) **Intensity-modulated dual-wavelength He-Ne laser for remote sensing of methane.** Uehara, K.; Taguchi, F. (Tokyo Gas Co. Ltd., Japan). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A new type of dual wavelength He-Ne laser is described in which the output power at each of the two wavelengths is modulated with equal amplitude and opposite phase to each other. This laser source can greatly simplify the setup and improve the sensitivity of the differential absorption measurements for methane detection, as verified by a preliminary experiment. A simple scheme to measure the concentration of methane is also proposed.

13959 (N—87-10263, pp vp) **Wide-area remote-sensing system of pollution and gas dispersal by near-infrared absorption based on low-loss optical fiber network.** Inaba, H. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

An all optical remote sensing system utilizing long distance, ultralow loss optical fiber networks is studied and discussed for near infrared absorption measurements of combustible and/or explosive gases such as CH_4 and C_3H_8 in our environment, including experimental results achieved in a diameter more than 20 km. The use of a near infrared wavelength range is emphasized.

13960 (N—87-10263, pp vp) **Mobile system for active optical pollution monitoring.** Sunesson, A.; Edner, H.; Svanberg, S.; Uneus, L.; Wendt, W.; Fredriksson, K. (National Swedish Environment Protection Board, Stockholm). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The remote monitoring of atmospheric pollutants can now be performed in several ways. Laser radar techniques have proven their ability to reveal the spatial distribution of different species or particles. Classical optical techniques can also be used, but yield the average concentration over a given path and hence no range resolution. One such technique is Differential Optical Absorption Spectroscopy, DOAS. Such schemes can be used to monitor paths that a preliminary lidar investigation has shown to be of interest. Having previously had access to a mobile lidar system, a new system has been completed. The construction builds on experience from using the other system and it is meant to be more of a mobile optical laboratory than just a lidar system. A complete system description is given along with some preliminary usage. Future uses are contemplated.

13961 (N—87-10263, pp vp) **Gas correlation lidar for methane detection.** Galletti, E.; Zanzottera, E.; Draghi, S.; Garbi, M.; Petroni, R. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A new type of DIAL system for the detection of methane in the atmosphere is being developed. The main feature of this lidar is the use of a gas correlation technique to obtain the reference signal by means of a single laser pulse, instead of two shots at different wavelengths. This fact is useful to make measurements on fast moving platforms. To meet the infrared absorption band of methane an optical parametric oscillator (OPO) was used with a $LiNbO_3$ crystal as active element, and a tuning range between 1.5 divided by 4 microns. As known, the major problem to overcome in parametric oscillators are the pump beam quality and the difficulty in reducing the linewidth. The first requirement is met by using, as a pump, a Nd-YAG laser based on a new type of resonator cavity, named SFUR (Self Filtering Unstable Resonator). The laser emits, with high efficiency, near diffraction limited pulsed beams of about 250 mJ of energy, 20 ns of duration at 10 pps of frequency repetition rate. On the other hand, the gas correlation technique allows the operation with a bandwidth as large as 1/cm, which is obtainable using only a diffraction grating as a dispersive element in the OPO cavity.

13962 (N—87-10263, pp vp) **Pulsed mononode dye laser developed for a geophysical application.** Jegou, J.P.; Pain, T.; Megie, G. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

Following the extension of the lidar technique in the study of the atmosphere, the necessity of having a high power pulsed laser beam with a narrowed bandwidth and the possibility of selecting a particular wavelength within a certain spectral region arises. With the collaboration of others, a laser cavity using the multiwave Fizeau wedge (MWFW) was developed. Using the classical method of beam amplification with the aid of different stages, a new pulsed dye laser device was designed. The originality resides in the use of reflecting properties of the MFWF. Locally a plan wave coming with a particular angular incidence is reflected with a greater than unity coefficient; this is the consequence of the wedge angle which doubles the participation of every ray in the interferometric process. This dye laser operation and advantages are discussed. The feasibility of different geophysical applications envisageable with this laser is discussed.

13963 (N—87-10263, pp vp) **CO_2 lidar system for atmospheric studies.** Barbini, R.; Ghigo, A.; Giorgi, M.; Iyer, K.N.; Palucci, A.; Ribezzo, S. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A lidar facility using a TEA CO_2 laser source is being developed at the ENEA Laboratories for Atmospheric Studies. The different subsystems and the proposed experimental activities are described.

13964 (N—87-10263, pp vp) **GSFC gound-based lidar for the measurement of stratospheric ozone.** Mcgee, T.J. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

Concern has risen over the last decade concerning the release of gases into the atmosphere which when photolyzed in the stratosphere can catalyze the destruction of ozone. Although the expected change is only on the order of 5%, significant changes in the vertical profile are anticipated. Predictions at 40 km run as high as a 60% change in the next 50 to 100 years. Because of the importance of ozone in the thermal budget of the atmosphere, such a change will have a direct impact on the earth's climate. Long term monitoring of stratospheric ozone is required to validate the predictions and Differential Absorption Lidar is particularly well suited to this measurement. GSFC is currently constructing a mobile lidar system based on a high powered XeCl excimer laser. The system is expected to be operating by fall 1986 and a campaign to compare the lidar results with a series of ROCOZ flights is planned.

13965 (N—87-10263, pp vp) **Linewidth characteristics of Raman-shifted dye laser output at 720 and 940 nm.** Grossmann, B.E.; Singh, U.N.; Higdon, N.S.; Cotnoir, L.J.; Wilkerson, T.D.; Browell, E.V. (Maryland Univ., College Park). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A compact and simple simultaneous multi-wavelength dye laser cavity was developed for a differential absorption technique. Dielectric multilayer interference filters were inserted inside the cavities as tuning elements, and two types of a DIAL system were constucted by using the dye laser tuned with dielectric multilayer filters to measure NO_2 concentration. The usefulness of this dye laser was clarified for the differential absoroption technique in outdoor experiments. Some basic designs of the laser cavity with these filters to get simultaneously multi-wavelength output are summarized.

13966 (N—87-10263, pp vp) **Alexandrite laser source for atmospheric lidar measurements.** Pelon, J.; Loth, C.; Flamant, P.; Megie, G. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

During the past years, there has been a marked increase in interest in the applications of vibronic solid state lasers to meteorology and atmospheric physics. Two airborne lidar programs are now under development in France. The differential absorption lidar (DIAL) method with vibronic solid state lasers is very attractive for water vapor, temperature and pressure measurements. Alexandrite laser and titanium-sapphire are both suitable for these applications. However, only alexandrite rods are commercially available. The requirements on the laser source for airborne dial applications are two fold: (1) a restriction on laser linewidth and a requirement on stability and tunability with a good spectral purity; and (2) a requirement on the time separation between the two pulses. These constraints are summarized.

13967 (N—87-10263, pp vp) **TFP and a pulsed LD: new lidar components.** Shimizu, H.; Matsui, I.; Asai, K. (Tohoku Univ., Sendai, Japan). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

One of the large problems of lidar in practical use is that the price and the weight of a laser and a receiving telescope is too high. To solve this problem, many trials have been made. The system with the TFP (thin film paraboloid) for a receiving telescope and a pulsed LD (laser diode) for a laser source is proposed. It is hoped that as a consequece the lidar system will become very lightweigth and inexpensive.

13968 (N—87-11024, pp vp) **Single longitudinal mode operation of semiconductor laser arrays with etalon control.** Hemmati, H. Aug 1986. NTIS, PC A14/MF A01. (NASA-CR—179715; JPL-TDA-PR—42-86; NAS—1.26:179715).

In Telecommunications and Data Acquisition Report.

A simple method is devised to obtain a single longitudinal output beam from high-power multilongitudinal mode diode laser arrays. Mode control is achieved by simply placing a thin etalon in front of the laser. The three-cavity laser formed by addition of the etalon favors a single longitudinal mode. This technique is applicable to both continuous wave and pulsed laser modes of operation. Experimental results demonstrating the technique along with future work and possible applications are discussed.

13969 (SAND—86-2249C) **Generation of 130 nm light by sum frequency mixing in Hg vapor.** Smith, A.V.; Alford, W.J.; Hadley, G.R. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 5p. (CONF-8610208—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87002479.

From Workshop on nonlinear optical techniques for SDI applications; Albuquerque, NM, USA (28 Oct 1986).

Excitation of atomic oxygen in the upper atmosphere can be achieved using 130 nm light to pump the 2^3P - 3^3S atomic transition. One particular SDI application requires a high optical quality beam of energy several orders of magnitude greater than has been demonstrated using nonlinear sum frequency mixing in this wavelength region.A mixing scheme in Hg vapor has been identified which may provide the high conversion efficiency and scalability required. The frequency conversion process has been modeled and careful measurements have been made of the crucial atomic parameters. 4 refs.

13970 (UCRL—95040) **Laser microfabrication technology and its application to high speed interconnect of gate arrays.** Bernhardt, A.F.; McWilliams, B.M.; Mitlitsky, F.; Whitehead, J.C. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 18p. (CONF-861207—32). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004363.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A goal of the LLNL Laser Pantography (LP) program has been demonstrating processes in which a computer-steered and computer-modulated laser beam directly deposits or removes material onto or from a substrate such as a silicon wafer. Substantial advantages could accrue from a fully developed set of such processes, including: lower cost for prototyping and low volume manufacturing, faster fabrication, on-line repair, and customized computers. 7 refs., 10 figs.

13971 (UCRL—95423) **Frequency conversion materials from a device perspective.** Eimerl, D. (Lawrence Livermore National Lab., CA (USA)). 19 Sep 1986. Contract W-7405-ENG-48. 10p. (CONF-860880—42). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003468.

From 30. SPIE technical symposium on optics and optoelectronic engineering; San Diego, CA, USA (17 Aug 1986).

The optimization of nonlinear optical devices such as frequency doublers is discussed. A nonlinear material will convert efficiently if the laser brightness (P/Q^2, where P is the peak power, and Q is the number of times diffraction-limited the pulse is) exceeds a material parameter called the threshold power. The conversion efficiency is shown to be independent of the beam aperture. Thus surmounting optical damage requires only that the beam aperture be large enough. Data on the threshold powers of common nonlinear materials is presented.

13972 **Bistable two-mode lasers and most probable tunneling paths.** Wang, X.W.; Lin, D.L.; Hioe, F.T. (Dept. of Physics and Astronomy, State Univ. of New York at Buffalo, Amherst, NY 14260). pp 383-384 of Optical instabilities. Boyd, R.W.; Raymer, M.G.; Narducci, L.M. New York, NY; Cambridge University Press (1986). (CONF-850639—).

From Instabilities and dynamics of lasers and nonlinear optical systems; Rochester, NY, USA (18 Jun 1985).

New analytic results for the mode-switching characteristics of bistable two-mode lasers, obtained from a potentially powerful technique utilizing curved (non-straight) most probable tunneling paths, are presented. Bistability is a problem of considerable interest in many fields of physics. The problem generally involves mode competition through nonlinear dynamics, quantum and classical fluctuations, and probability of "tunneling" from one metastable state to another. When the mode-coupling is an adjustable parameter as in the case of recent experiments involving a free running broad band, standing-wave cw dye laser, the transition from a many-mode to a two-mode operation has the characteristic of a thermodynamic phase transition at a certain critical point.

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REFER ALSO TO CITATION(S) 13487, 13488, 13550, 13551, 13709, 13869, 13870, 13872, 13873, 14221

13973 (AD-A—174153/7/XAB) **Comparison study of the eigenvalue method for the solution of the transient heat-conduction equation. Master's thesis.** Gee, D.B. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Jan 1986. 52p. (AFIT/GNE/ENP—86M-6). NTIS, PC A04/MF A01.

This is a comparison study of the abilities of the eigenvalue method as a numerical method in solving the transient heat-conduction equation. The eigenvalue method was compared to five other numerical methods; Runge-Kutta, Gears, extrapolation, fully implicit, and Crank-Nicolson. These methods were used to solved three physical problems. The first is a two-dimensional slab that takes advantage of the symmetry of the problem. The second is a the same slab problem without taking advantage of the symmetry. And the third is a cylindrical problem taking full advantage of symmetry. The scope of the study is to see which methods take less computer time while maintaining sufficient accuracy. The time it takes the computer to totally execute the program was used as the time-comparison basis. The accuracy is a comparison of the exact solution to the numerical solution. A root mean square average off all the grid points per time step is used. The results of the study were surprising. The accuracy of the eigenvalue method is not any better than

that of the Crank-Nicolson method. The computer times show that the eigenvalue is not the fastest for short transient times. A long transient problem with nonlinear terms was not used in this study.

13974 **(AD-A—174377/2/XAB) Effects of oil contamination on the nucleate pool-boiling behavior of R-114 from enhanced surfaces. Master's thesis.** Sawyer, L.M. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1986. 148p. NTIS, PC A07/MF A01.

The external nucleate-pool-boiling heat-transfer coefficient of both smooth and enhanced horizontal tubes in R-114-oil mixtures (0 to 10 mass percent oil) were measured for heat fluxes from 1 to 91 kW/sq m at a saturation temperature of 2.2 C. The enhanced tubes tested were a Wieland GEWA-T finned tube containing 1.02 fins/mm, a Hitachi Thermoexcel-E and a Hitachi Thermoexcel-HE tube. The Theromoexcel-E and -HE tubes with their reentrant-cavity designs were found to improve the heat-transfer coefficient over the smooth tube value at a constant heat flux by a factor of approximately 7 in oil-free R-114, while the GEWA-T tube improved the coefficient by a factor of about 4. While all of the tubes showed a generally decreasing performance with the presence of oil, the GEWA-T tube resulted in a minimum reduction. This tube showed up to 20% and 35% reduction (compared to the oil-free case) at 3% and 10% oil, respectively. The Thermoexcel-E and Thermoexcel-HE tubes showed performance reductions of up to 40 and 60%, respectively, with 3% oil. At a practal heat flux of about 30 kW/sq m with 3% oil, the GEWA-T, Thermoexcel-E and Thermoexcel-HE tubes outperformed the smooth tube by factors of 4.8, 4.6, and 4.0, respectively.

13975 **(DOE/CE/90234—T1) Multicomponent flow compressor: A new concept for efficient energy conversion: Final report for period 10 June 1985-9 June 1986.** Minardi, J.E.; von Ohain, H.P.; Lawson, M.O.; Newman, R.K.; Wattendorf, F.L. (Dayton Univ., OH (USA). Research Inst.). Dec 1986. Contract FG01-85CE90234. 82p. (UDR-TR—86-139). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004011.

The research program reported herein is based on an innovative concept of tailoring a multicomponent flow by controlled injection of uniform-size, several-micron-diameter particles in a gas flow, such as air or helium for admission to a compressor rotor, so as to obtain greatly improved compressor performance characteristics: three such major improvements over present technology are lowest work of compression (essentially isothermal), low rotor tip speeds, and very high compressor pressure ratios in a single stage. The objectives of the first phase were to demonstrate the effects of tailoring the multicomponent flow on the compressor pressure rise and to provide the conceptual design of the major elements of the multicomponent flow compressor system. A high specific speed rotor with 40 blades was designed and built. The rotor was housed in a vaneless diffuser and scroll designed to diffuse the particle laden gas. Preliminary data obtained with the compressor rig shows a 40% increase in pressure using particles when compared to the air only values. However, theory indicates that substantial gains in performance are still possible. Modifications to the compressor rig are presented and will be used to obtain additional data at higher particle loadings.

13976 **(DOE/ER/12022—1) Heat transfer in oscillatory flow: Final report.** Telionis, D.P.; Diller, T.E. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Nov 1986. Contract AS05-82ER12022. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004374.

This is the final report on a 4-year research effort funded by DOE. The bulk of the material has been included in numerous publications which are listed in a later section. Most of these have appeared already in archival journals. The most recent work is included in two Ph.D. dissertations. Since most of the material is already documented in detail in the publications mentioned above, we confine the discussion here to highlights of the results.

13977 **(DOE/ER/13398—2) Effects of interfacial waves on heat transfer to free-falling turbulent liquid films.** Shmerler, J.A.; Mudawwar, I.A. (Purdue Univ., Lafayette, IN (USA). Boiling and Two-Phase Flow Lab.). Dec 1986. Contract FG02-85ER13398. 15p. (CONF-861204—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003983.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

The close association of the transport processes of falling films to the design of heat exchangers, distillation columns and thin film evaporators has stimulated many numerical and analytical studies to better characterize this type of flow. The earliest work of note was performed by Nusselt in 1916 when he solved the momentum and energy equations for a laminar gravity driven film. However, true laminar flow exists only at very low Reynolds numbers ($Re<30$), making these solutions impractical for many engineering calculations. Since the 1950's the majority of studies have focused on solving the more complicated cases of film flow in the transitional region, also known as the wavy laminar region, and fully turbulent flow. These studies have been generally aimed at determining heat transfer coefficients either experimentally or numerically.

13978 **(DOE/ER/13398—3) Characteristics of interfacial waves on freely-falling liquid films.** Koskie, J.E.; Mudawwar, I.A.; Tiederman, W.G. (Purdue Univ., Lafayette, IN (USA). Boiling and Two-Phase Flow Lab.). 1986. Contract FG02-85ER13398. 11p. (CONF-861204—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003984.

From 4. Miami international symposium on multi-phase transport and particulate phenomena; Miami Beach, FL, USA (15 Dec 1986).

Experiments were performed to determine the statistical characteristics of interfacial waves in free-falling films and to gain a better understanding of turbulent activity in thick wavy films. The development of a new conductance probe made it possible to accurately measure instantaneous film thicknesses greater than two millimeters. This study focuses on interfacial waves in turbulent falling liquid films with average film thicknesses in the range 0.5 to 1.75 mm. Characterization of the wave profiles, wave frequency spectra and average film thickness are presented for a wide range of flow rates.

13979 **(DOE/PC/90962—T1) Experiments on densely-loaded non-Newtonian slurries in laminar and turbulent pipe flows: Quarterly technical progress report No. 1.** Park, J.T.; Mannheimer, R.J.; Grimley, T.A.; Morrow, T.B. (Southwest Research Inst., San Antonio, TX (USA)). 26 Jan 1987. Contract FG22-86PC90962. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004486.

An experimental evaluation of the structure of non-Newtonian slurries in laminar, transitional, and turbulent flow regimes in pipes is the primary objective of this research. Experiments will be conducted in a large scale pipe slurry flow facility with an inside pipe diameter of 50 mm (2 inches). Detailed flow measurements including turbulence quantities such as Reynolds stress will be taken with a two-component laser Doppler velocimeter (LDV) in a transparent test section with a transparent model slurry. During the past quarter, a transparent model slurry was developed with non-Newtonian rheological properties. Silica gel particles with diameters less than one micron were suspended in a mixture of 70.3% Stoddard Solvent (a saturated hydrocarbon) and 29.7% Exxon 150 (an aromatic hydrocarbon) by weight. The refractive index was measured as 1.4543, and the difference in refractive indices between the solids and the liquid was estimated to be less than 0.001. In rheological measurements with a concentric cylinder viscometer, a slurry with 5.6% solids by weight exhibited both slip and power law behavior. Qualitative results also indicate that the model slurry has a yield value. An adequate signal-to-noise ratio was measured in the model slurry with a two-component LDV system during bench scale tests. Several other items of significance were also completed. A Plexiglas dye injector was fabricated for the flow visualization experiments. The device contains a circumferential injector slot for visualization of wall phenomena. Test section design has been completed and fabrication is in progress. Flow visualization experiments will be initiated during the next quarter. 15 refs., 7 figs., 1 tab.

13980 **(INIS-BR—450) Numerical model for the solution of two-dimensional natural convection problems in arbitrary cavities.** Milioli, F.E. (Santa Catarina Univ., Florianopolis (Brazil). Programa de Pos-graduacao em Engenharia Mecanica). 1985. 183p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. File Number DE86780519.

In this research work a numerical model for the solution of two-dimensional natural convection problems in arbitrary cavities of a Boussinesq fluid is presented. The conservation equations are written in a general curvilinear coordinate system which matches the irregular boundaries of the domain. The nonorthogonal system is generated by a suitable system of elliptic equations. The momentum and continuity equations are transformed from the Cartesian system to the general curvilinear system keeping the Cartesian velocity components as the dependent variables in the transformed domain. Finite difference equations are obtained for the contravariant velocity components in the transformed domain. The numerical calculations are performed in a fixed rectangular domain and both the Cartesian and the contravariant velocity components take part in the solution procedure. The dependent variables are arranged on the grid in a staggered manner. The numerical model is tested by solving the driven flow in a square cavity with a moving side using a nonorthogonal grid. The natural convection in a square cavity, using an orthogonal and a nonorthogonal grid, is also solved for the model test. Also, the solution for the buoyancy flow between a square cylinder placed inside a circular cylinder is presented. The results of the test problems are compared with those available in the specialized literature. Finally, in order to show the generality of the model, the natural convection problem inside a very irregular cavity is presented.

13981 **(INIS-BR—451) Simultaneous heat and moisure transfer in porous elements: transfer function method.** de Souza, H.A. (Santa Catarina Univ., Florianopolis (Brazil). Programa de Pos-graduacao em Engenharia Mecanica). 1985. 179p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. File Number DE86780520.

The presence of moisture in a porous element may strongly affect the transfer of heat through this element due to the processes which occur associated with the phase changes at the boundary surfaces and internally in the wall body. In addition, the structural properties of the element may also be meaningfully affected. The formulation of mathematical models for the simultaneous heat and mass transfer in porous elements results in a pair of nonlinear coupled equations for the temperature and moisture content distributions, in the material. It is supposed, in this work, that the actual variation of the properties of the porous medium is small in the range of variables which describe the specific problem to be analyzed. This enables us to work with linearized equations, making possible the use of linear solution methods. In this context, the present work deals with a linear procedure for the solution of simultaneous heat and moisture transfer problems in porous elements, subjected to arbitrary boundary conditions. This results in a linear relation between the heat and mass flux densities through the boundary surfaces of the elements and their associated potentials. It is shown that the model is consistent in asymptotical limiting cases; the model is then used for analyzing the drying process of a porous element, subjected to ambient actual conditions.

13982 **(ISAS-SP—) Proceedings of the symposium on mechanics for space flight, 1985.** Oda, M. (Tokyo Univ. (Japan)). 1985. 266p. (CONF-8511254—). NTIS, PC A12/MF A01.

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

This 15th symposium was held on November 7 and 8, 1985 at the Japanese Institute of Space and Astronautical Science. The symposium program consisted of seven oral sessions: Vortical Flow; Flow around Flight Vehicles; Computational Fluid Dynamics; Space Environment Control; Elementary Processes in Heat Pipes; Analysis of Heat Pipe Systems; Applications of Heat Pipes; and one panel discussion on Research and Development of Total Energy Systems for Space. During the Computational Fluid Dynamics Session, a report on the International Symposium on Computational Fluid Dynamics in Tokyo was presented.

13983 **(ISAS-SP—4, pp vp) Analysis on gravitational effect to nonlinear diffusion system of vapor molecules in a heat pipe.** Etori, K. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

A nonlinear diffusion equation with a diffusion coefficient depending on number density of diffusing particles affected by gravity is approximately solved in a steady state. Characteristic properties of vapor molecules in a heat pipe are analyzed as a diffusion process of Brownian particles. In order to explain the nonlinear shifts from a linear diffusion system in conventional theories, the expectation values and the variance of number density of vapor molecules are calculated by using the theory of stochastic processes. As a result, a diffusion thermal resistance of a heat flow in a heat pipe is estimated by taking an average value of the diffusion coefficient in a nonlinear system.

13984 **(ISAS-SP—4, pp vp) Effect of surplus standing liquid on heat transfer resistance in the heat pipe (with mesh wick in a horizontal mode).** Kamata, M.; Ikeda, Y. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

It is an engineering practice to fill a heat pipe with working fluid of a quantity a little larger than the clearance volume of the screen wick as the most desirable volume of working fluid is unknown. However, it is foreseeable that excessive volume of working fluid deteriorates the performance of the heat pipe. A new method is discussed for computing heat flow and temperature distribution in a heat pipe with the assumptions that the depth of working fluid in the heat pipe can be calculated from the pressure losses in the evaporation and condensation zones, that surplus fluid adheres to the inner wall of the screen wick forming a cylindrical layer of liquid, and that the heat transfer resistance of the container, screen wick and cylindrical layer of working fluid are connected in series. To validate the computation, experiments were performed and good agreement was obtained.

13985 **(ISAS-SP—4, pp vp) Dynamic heat transfer mechanism of two-phase closed thermosyphon.** Negishi, K.; Kaneko, K.I.; Kusumoto, F. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

The heat transfer mechanism of a two phase closed thermosyphon was dynamically analysed in the periodically motive behavior of working fluid with boiling. It is an important problem in order to obtain high heat transfer performance, how the liquid film of the working fluid can be held for a longer time on the wider area of the evaporator heating wall, and how the active evaporation can be kept there.

13986 **(ISAS-SP—4, pp vp) Trial on performance test method for Cu-water heat pipe.** Tanaka, Y.; Yamamoto, T. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

Because of the increased demand for heat pipes, the establishment of standard methods for performance testing and the performance expression was requested. Generally, the measurement method for the heat transfer rate of heat pipes is divided into two categories. That is, the heat transfer rate of a heat pipe is measured by heat input to the evaporator surface or the quantity of heat removed from the condenser zone. The heat loss in each method described must be determined by circulating some kind of fluid such as water in the same size pipe located in the heating unit instead of the heat pipe under actual operating condition before use. The heat transfer rate of a Cu-water heat pipe is measured by means of this measurement method based on the principle of bomb calorimetry. The obtained measuring accuracy may be lower.

13987 **(ISAS-SP—4, pp vp) High capacity heat pipe with axial grooves.** Miyazaki, Y.; Ido, Y. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

A new type of high capacity heat pipe for spacecraft use was fabricated and tested. The heat pipe consists of an outer pipe and an inner pipe. The outer pipe is a container and it has two channels, one for liquid and one for vapor. The inner pipe is provided with axial grooves and circumferential slits, and it is inserted into the vapor channel of the outer pipe. The circumferential slits connect the liquid channel and the axial grooves. Preliminary test results for the first 1 m long development model are presented and discussed, relative to its heat transport capacity.

13988 (ISAS-SP—4, pp vp) **Third order compact schemes for fluid dynamic problems.** Tolstykh, A.I. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

The algorithms for viscous flows computations should meet higher requirements for such properties as stability, the absence of oscillations, etc. The first of these properties makes preferable implict schemes, the second one leads to an odd order of approximation. Computational practice has shown that from this point of view the three-point (compact) third order schemes proposed and investigated are efficient. These are actually high accuracy schemes when supplemented with grid points condensing in the computational regions with strong gradients. The discription of the third order compact schemes and of some applications to fluid dynamic problems is given.

13989 (ISAS-SP—4, pp vp) **Hydrodynamic and thermal interaction between two spheres in a steady viscous flow.** Zapryanov, Z.D.; Toshev, E.T. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

The investigation of the hydrodynamic and thermal interaction between two spheres moving in a viscous fluid is very important from a practical and fundamental point of view. This problem is topical in modeling suspensions, emulsions and many chemical technologies. An extension of the method of fractional steps to study the hydrodynamic and thermal interaction between two spherical particles in a steady viscous flow is presented. This numerical method yields good results from low to reasonably high Reynolds and Prandtl numbers.

13990 (ISAS-SP—4, pp vp) **Numerical method of calculation of two-dimensional stationary electro-gasdynamic internal flows.** Zhurin, V.V.; Shipilin, A.V. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

The suggested numerical method is meant for computations of two dimensional stationary internal nonviscous gas flows in a presence of a heat supply at expense of Joule heating. Such flows and processes take place in the plasma thrusters and in the working regions of the electro-ionizing lasers. The numerical solution of the Euler equations for subsonic and transonic regimes are considered. For computations of supersonic internal flows the method of characteristics is a very effective method. The method suggested allows an easy connection with the method of characteristics.

13991 (LCC—012/85) **Model to analyse the flow of an incompressible Newtonian fluid through a rigid, homogeneous, isotropic and infinite porous medium.** da Gama, R.M.S.; Sampaio, R. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). 1985. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780542.

The flow of an incompressible Newtonian fluid through a rigid, homogeneous, isotropic and infinite porous medium which has a given initial distribution of the mentioned fluid, is analyzed. It is proposed a model that assumes that the motion is caused by concentration gradient, but it does not consider the friction between the porous medium and the fluid. We solve a one-dimensional case where the mathematical problem is reduced to the solution of a nonlinear hyperbolic system of differential equations, subjected to an initial condition given by a step function, called 'Riemann Problem.'

13992 (LCC—018/85) **Maximum principle for viscous fluids flowing through regions of pure fluid and mixtures.** da Gama, R.M.S.; Sampaio, R. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). 1985. 6p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780543.

A variational formulation for the problem of the flow of an incompressible Newtonian fluid through two, or more, regions is presented. Some of these regions are occupied only by the fluid and others by a saturated mixture of the fluid with a homogeneous rigid porous medium. The boundary between a region of pure fluid and another of mixture is formed by an impermeable interface that allows exchange of momentum but not of mass. The maximum of the functional is the solution of the problem.

13993 (N—87-11143) **Using a 3-dimensional laser anemometer to determine mean streamline patterns in a turbulent flow.** Orloff, K.L.; Snyder, P.K. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Jul 1984. 16p. (NASA-TM—85948; A—9723; NAS—1.15:85948). NTIS, PC A02/MF A01.

The determination of mean streamline patterns by moving the test point in the direction of the measured velocity is shown to produce cumulative errors that are unacceptable. A two-dimensional algorithm that minimizes these errors is presented and is analytically validated using simple potential flows. The algorithm is extended to three-dimensional flows and is again validated analytically. Finally, as an example of a typical application of the algorithm, mean streamlines are measured in a complex, turbulent flow with a three-dimensional laser anemometer.

13994 (N—87-11180, pp vp) **Effects of very high turbulence on convective heat transfer.** Moffat, R.J.; Maciejewski, P.K. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The effects of high-intensity, large-scale turbulence on turbulent boundary-layer heat transfer are studied. Flow fields were produced with turbulence intensities up to 40% and length scales up to several times the boundary layer thickness. In addition, three different types of turbulence will be compared to see whether they have the same effect on the boundary layer. The three are: the far field of a free jet, flow downstream of a grid, and flow downstream of a simulated gas turbine combustor. Each turbulence field will be characterized by several measures: intensity (by component), scale, and spectrum. Heat transfer will be measured on a 2.5 m long, 0.5 m wide flat plate using the energy-balance technique. The same plate will be used in each of the four flow fields; a low-turbulence tunnel for baseline data, and the three flow situations mentioned.

13995 (NP—7770056) **Non-steady process for determining heat transfer coefficients in beds with flow through them.** Beutler, R. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 19 Dec 1984. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87770056.

This work is concerned with determining the total heat transfer coefficients in heaps of solids with gas flowing through them, in which there are greatly changing temperature profiles with high temperature gradients. A non-steady measuring process was developed and tested to measure the total heat transfer coefficients. Due to the non-steady operation of a reactor, a wide range of temperatures and temperature gradients was produced at each point in the solid bed, in order to include the effect of absolute temperature and temperature gradients in the axial and radial direction. The radiation and power parts of heat transport in beds were also examined. (HAG).

13996 (PB—87-134383/XAB) **Investigation of horizontal flow boiling of pure and mixed refrigerants.** Ross, H.D. (National Bureau of Standards, Washington, DC (USA). Building Equipment Div.). Nov 1986. 359p. (NBSIR—86/3450). NTIS, PC A16/MF A01.

The research involved determining experimental heat-transfer coefficients (HTC), examining the phenomena involved in the physical process, and analyzing the predictive ability of available models and correlations. This work was done for pure R152a and R13B1 and for mixtures of these refrigerants. The mixtures yielded sharply lower heat transfer coefficients than either pure refrigerant. With pure refrigerants, full suppression of nucleate boiling (FSNB) occurs only at rather low pressures. Correlative evidence suggests that suppression is easier to achieve with mixtures than pure fluids. In the evaporation-dominated heat-transfer regime, Chen's correlation was successfully applied to the refrigerants with and without the occurrence of FSNB conditions. In the nucleate-boiling-dominated regime, the Stephan and Abdelsalam method was validated for pure fluids, and used successfully with Thome's method for mixtures. Pressure-drop correlations for pure fluids were also extended to mixtures without modification.

13997 **(SAND—86-0790C) Numerical simulation of buoyant convection in vented enclosures.** Schutt, J.A.; Baer, M.R. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 9p. (CONF-870304—3). NTIS, PC A02/MF A01. File Number DE86012941.

From 2. ASME/JSME thermal engineering conference; Honolulu, HI, USA (22 Mar 1987).

The buoyant convection in a two-dimensional enclosure with openings is solved using a primitive variable explicit finite difference technique. A non-Boussinesq acoustically-filtered formulation is used which models inviscid buoyantly driven flows in a stratified environment. The numerical algorithm uses the flux-corrected transport (FCT) technique to resolve energy and vorticity fields, and the pressure field is determined using a direct method for solving nonseparable elliptic equations. The numerical algorithm requires that pressure and kinetic energy be combined into a dynamic pressure field. A novel method is presented for treating inflow/outflow boundaries, where the direction of flow across the boundary is not known a priori. Demonstrative calculations are shown which simulate a fire environment in a vented room of planar geometry. The fire source is idealized as a distributed energy source. The calculations show the effect of venting on entrainment and induced flow.

13998 **Pressure and fluid to fluid scaling laws for two-phase flow loop.** Ishii, M.; Kocamustafaogullari, G.; Kataoka, I. (Reactor Analysis and Safety Div., Argonne National Lab., IL). pp 2259-2264 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

Scaling criteria for a natural circulation loop under single-phase and two-phase flow conditions are derived. Based on these criteria, practical applications for designing a scaled-down model are considered. Particular emphasis is given on scaling at reduced pressure levels relative to a prototype system and fluid to fluid scaling. It is a challenging problem to design a scaled-down model with different fluid properties due to a large number of similarity groups to be matched between a model and a prototype. The present study demonstrates a new approach to this classical problem using the two-phase flow scaling parameters. It indicates that a real time scaling is not a practical solution and a scaled-down model should have an accelerated (shortened) time scale. One of the most important results is the new scaling methodology for simulating pressure transients. It is obtained by considering the changes of the fluid property groups which appear within the two-phase similarity parameters and the single-phase to two-phase flow transition parameters.

13999 **Computed and experimental motion picture determination of bubble and solids motion in a two-dimensional fluidized-bed with a jet and immersed obstacle.** Lyczkowski, R.W.; Bouillard, J.; Gidaspow, D. (Energy and Environmental Systems Div., Argonne National Lab., 9700 S. Cass Ave., Argonne, IL). pp 2593-2598 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

Bubble and solids motion in a two-dimensional rectangular fluidized-bed having a high speed central jet with a rectangular obstacle above it and secondary air flow at minimum fluidization have been computer modeled. Computer generated motion pictures have been found to be necessary to analyze the computations since there are such a large number of time-dependent complex phenomena difficult to comprehend otherwise. Comparison of the computer generated motion pictures with high speed motion pictures of a flow visualization experiment reveal good agreement.

14000 **The application of flux-corrected transport (FCT) to high Rayleigh number natural convection in a porous medium.** Gross, R.J.; Baer, M.R.; Hickox, C.E. (Fluid and Thermal Sciences Dept., Sandia National Labs., Albuquerque, NM). pp 2641-2646 of Proceedings of the eighth international heat transfer conference. Tien, C.L.; Carey, V.P.; Ferrell, J.K. New York, NY; Hemisphere Publishing (1986). (CONF-860805—).

From International heat transfer conference; San Francisco, CA, USA (17 Aug 1986).

A finite difference numerical technique, designed to solve convectively dominated flow problems, is applied to high Rayleigh number natural convective flow in a porous medium. This technique, flux-corrected transport (FCT), is known to possess the numerical properties of stability, accuracy, monotonicity, and conservation. Steady natural convection is investigated for Rayleigh numbers as large as 10,000. An efficient methodology for obtaining steady state solutions is used. A simulation is demonstrated for transient thermal convection at a Rayleigh number of 2500. Transient natural convection involving both heat and mass transfer is further illustrated for a Rayleigh number of 2500, Lewis number of 2, and buoyancy ratio of 0.1. All simulations considered a square cavity with heated vertical side walls.

14001 **Physical model of gradient zone erosion in thermohaline systems.** Hull, J.R.; Mehta, J.M. (Argonne National Lab., Argonne, IL 60439-4825). pp 279-283 of Proceedings of ASES 86 annual meeting. New York, NY; American Solar Energy Society (1986). (CONF-860665—).

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

A model is formulated for gradient zone erosion in thermohaline systems. The model includes effects at gradient zone boundaries of mildly turbulent thermals in adjacent convecting zones. The model predicts microconvection within the gradient zone, with an amplitude that decays exponentially away from the boundaries. The predicted thickness of observable disturbance agrees with observation. Applying the theory to stability of the boundary yields erosion behavior that agrees with an empirical correlation for boundary equilibrium.

14002 **Analysis of fluid/solid interaction in hydraulic fracturing: Transition between laminar and turbulent flows.** Griffiths, S.K.; Nilson, R.H. (Sandia National Labs., Livermore, CA). pp 31-40 of Fluid transients in fluid-structure interaction - 1985. Dodge, F.T.; Moody, F.J. New York, NY; American Society of Mechanical Engineers (1985). (CONF-851125—). Contract AC04-76DP00789.

From American Society of Mechanical Engineers winter annual meeting; Miami, FL, USA (17 Nov 1985).

Fluid/solid interaction in hydraulic fracturing is analyzed using a fully-transient model of the one-dimensional fluid motion along the fracture, coupled with a quasi-steady model of the two-dimensional solid displacement. Self-similar solutions are derived for special cases in which flow along the fracture is either laminar, rough-wall turbulent or smooth-wall turbulent. The non-similar transition between regimes is additionally analyzed using a method-of-lines numerical procedure. Here, the governing equations are spatially discretized on a straining co-ordinate system, and the resulting coupled ordinary differential equations are integrated forward in time. Matrix inversion and a Runge-Kutta algorithm are employed to directly account for the fluid/solid interaction. A series of comparisons illustrate good agreement between results of

the two solution techniques and between results for various treatments of the transition regimes.

14003 **Zero-gravity slosh analysis.** Eastes, T.W.; Chang, Y.M.; Hirt, C.W.; Sicilian, J.M. (Rockwell International/ Rocketdyne Div., Canoga Park, CA). pp 41-48 of Fluid transients in fluid-structure interaction - 1985. Dodge, F.T.; Moody, F.J. New York, NY; American Society of Mechanical Engineers (1985). (CONF-851125—).

From American Society of Mechanical Engineers winter annual meeting; Miami, FL, USA (17 Nov 1985).

Experimental results were used to anchor a newly developed three-dimensional, finite-difference hydrodynamics code that was designed to simulate large amplitude slosh in a container moving in a zero-g environment. The results of this anchoring are presented along with a brief description of the SOLA-SLOSH code, a description of the experiment, and a description of how the code was used to model pointing errors of a liquid-filled spacecraft during its space maneuvers.

14004 **Front tracking finite element study on change of phase interface stability during solidification processes in solutions.** Tsai, H.L.; Rubinsky, B. (Lawrence Berkeley Lab., CA). *Journal of Crystal Growth;* 70: 56-63(1984). Contract AC03-76SF00098.

A new numerical method was developed which uses front tracking finite elements for the solution of multidimensional transient heat and mass transfer diffusion equations during solidification processes in binary alloys or solutions. The method can cope with irregular geometrical domains and irregular, transient, solid-liquid interface geometrical morphologies. The method was employed in a study on the morphological stability of a solid-liquid interface, during transient solidification in a solution in a finite domain. The stability was studied by imposing (a) a numerical perturbation on the temperature boundary conditions and (b) a concentration perturbation on the solid-liquid interface. The analysis has shown that under similar conditions the interface is stable to temperature perturbations and conditionally unstable to concentration perturbations. An explanation of the results was presented in terms of transient heat and mass transfer processes during solidification. 15 references, 9 figures, 1 table.

4205 Materials Testing

REFER ALSO TO CITATION(S) 13396, 14097

14005 **(CONF-861207—34) Diffraction studies of cobalt precipitates in a Cu-0.95 at. % Co alloy.** Spooner, S.; Iida, S.; Larson, B.C. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02/ MF A01; 1; GPO Dep. File Number DE87004277.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

A detailed comparison of small-angle scattering (SANS) and large angle x-ray diffraction methods of characterization of precipitates was undertaken. Cobalt-rich precipitates on the order of 50 A developed after a 17 hour anneal at 570°C were studied in a single crystal sample with SANS and with diffuse x-ray scattering near the (400 Bragg peak. Each scattering data set was analyzed independently in terms of a distribution of precipitate sizes; a detailed comparison is made of the size distribution obtained. A small interparticle interference effect is seen.

14006 **(N—86-31912) Factors that affect reliability of nondestructive detection of flaws in structural ceramics.** Klima, S.J.; Baaklini, G.Y.; Roth, D.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 11p. (NASA-TM—87348; E—3096; NAS—1.15:87348; CONF-860413—4). NTIS HC A02/MF A01.

From 2. international symposium on ceramic materials and components for engines; Luebeck-Travemuende, F.R. Germany (14 Apr 1986).

The factors that affect reliability of nondestructive detection of flaws in structural ceramics by microfocus radiography and scanning laser acoustic microscopy (SLAM) were investigated. Reliability of void detection in silicon nitride and silicon carbide by microfocus X-rays was affected by photon energy level, material chemistry in the immediate vicinity of the void, and the presence of loose powder aggregates inside the void cavity. The sensitivity of SLAM to voids was affected by material microstructure, the level of porosity, and the condition of the specimen surfaces. Statistical results are presented in the form of probability of detection as a function of void diameter for green compacts and sintered materials.

14007 **(SAND—86-2753C) Radiographic image subtraction: WANTO [Weapons Agencies Nondestructive Testing Organization] '86.** Hansche, B.D.; Sample, D.G. (Sandia National Labs., Albuquerque, NM (USA)). 24 Nov 1986. Contract AC04-76DP00789. 14p. (CONF-861195—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003515.

From 29. meeting of the Weapons Agencies Nondestructive Testing Organization (WANTO); Amarillo, TX, USA (18 Nov 1986).

Image subtraction is an old but useful technique that needs occasional resurrection to remind us all that it exists. It is useful mainly when small changes must be detected. Here "small changes" can refer to physically small components in complex images, or small changes in intensity (density). It is mainly applicable when changes in a particular part are to be detected, in a before-after situation. It can be applied to detect differences between a part and a "master part" if the "production" parts differ from the master in ways which are small compared with the features one is attempting to detect. Even if the production part differs significantly from the master, it is often useful to make a negative mask as an aid to interpretation of the radiograph.

14008 **Review of progress in quantitative nondestructive evaluation. Volumes 5A & 5B - Proceedings of the Twelfth Annual Review, Williamsburg, VA, June 23-28, 1985.** Thompson, D.O.; Chimenti, D.E. New York, NY; Plenum Press (1986). 1850p. (CONF-8506110—).

From Review of progress in quantitative NDE; Williamsburg, VA, USA (23 Jun 1985).

Papers are presented on microfocus X-ray technology and conventional methodologies including ultrasonics, eddy current inspection, thermal wave scattering and acoustic emission. Also considered are inversion, imaging and reconstruction, systems and reliability, electronic material and devices, and federal science policy and technology transfer. Other topics include sensors and signal processing, and the process control, properties, and defects of composite materials. Papers are also presented on materials characterization including properties, acoustoelasticity and stress, processes, deformation, porosity, and weldments.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 13318, 13354, 13937, 13970, 14094, 14405

14009 **(BDX—613-3638) Evaluation of solder flux solvents in a vapor-degreasing application for hybrid microcircuits: Final report.** Adams, B.E. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Jan 1987. Contract AC04-76DP00613. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004554.

Vapor degreasing hybrid microcircuits with an azeotropic mixture of trichlorotrifluoroethane and methanol; an azeotropic mixture of trichlorotrifluoroethane, hexane, and methyl chloride; and 1,1,1 trichloroethane was evaluated to find a replacement for cold-cleaning with the more toxic trichloroethylene. Vapor degreasing reduces solvent usage, and replacing trichloroethylene would reduce potential health risks within the microelectronics department. From visual inspection and Meseran number it was determined that vapor degreasing with 1,1,1 trichloroethane could be an acceptable replacement process.

14010 **(LA-UR—86-3973) Resonant cavity operation of a virtual cathode oscillator.** Fazio, M.V.; Hoeberling, R.F. (Los Alamos National Lab., NM (USA)). 01 Dec 1986. Contract W-7405-ENG-36. 5p. (CONF-861240—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003714.

From 3. national conference on high power microwave technology for defense applications; Albuquerque, NM, USA (1 Dec 1986).

Gigawatt level virtual cathode sources have been proposed for several applications. These include microwave weapons and drivers for high-energy particle accelerators. Both of these require a microwave source with very high power output that is controllable in frequency and phase. A conventional virtual cathode oscillator will not meet these requirements. The addition of a resonant cavity surrounding the oscillating virtual cathode either alone or pumped with a low-power injection signal, causing it to operate as an amplifier, could greatly influence the performance of this type of source making it more practical for accelerator and weapon applications. The progress on an experiment to test these concepts will be discussed.

14011 **(UCRL—94192) Efficient methods for evaluating the effects of stressful electromagnetic environments on complex systems.** Corynen, G.C. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 7p. (CONF-870305—1). NTIS, PC A02/MF A01. File Number DE86008030.

From EMC symposium and exhibition special seminar: EMP effects on power systems; Zurich, Switzerland (3 Mar 1987).

An efficient method for evaluating the effects of stressful electromagnetic (EM) environments on complex systems has been developed. Using failure information about the system components, the new method accurately and reliably computes the overall response of systems consisting of hundreds or even thousands of highly interactive components. Quantitative comparisons with current methods are shown and specific applications to practical large-scale systems are reported, with emphasis on threats due to Electromagnetic Pulse (EMP).

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 13718, 13933

4210 Combustion Systems

REFER ALSO TO CITATION(S) 13059, 13125, 13126, 13127, 13128, 13170, 13191, 13431, 13432, 13433, 13994

14012 **(AD-A—173980/4/XAB) RDF (refuse-derived fuel) co-firing cost/benefit analysis using the NCEL RDF Cost Model. Volume 1. Project results. Final report, September 1985-August 1986.** Belencan; Smith. (Systech Corp., Xenia, OH (USA)). Aug 1986. 56p. NTIS, PC A04/MF A01.

The object of this effort was to determine the cost-effectiveness of co-firing RDF in existing Navy boilers. The cost-benefit analysis was performed using the NCEL RDF Cost Model and site-specific boiler and cost data acquired from four naval activities that were determined to have the highest probability of successful co-firing. The cost effectiveness was measured by the savings-to-investment ratio (SIR) and computered over a range of cost and operating conditions to determine optimum RDF co-firing scenarios for each facility. Based on present laid-down coals costs and solid-waste disposal charges, no set of operating conduction could be identified wherein the use of either co-fired RDF-3 or RDF-5 could be economically justified. This volume presents the report; Volume II contains appendixes, and Volume III is the terminal manual of RDf cost model. (Author)

14013 **(AD-A—173981/2/XAB) RDF (refuse-derived fuel) co-firing cost/benefit analysis using the NCEL RDF Cost Model. Volume 2. Appendixes. Final report, September 1985-August 1986.** Belencan; Smith. (Systech Corp., Xenia, OH (USA)). Aug 1986. 242p. NTIS, PC A11/MF A01.

The object of this effort was to determine the cost-effectiveness of co-firing RDF in existing Navy boilers. The cost-benefit analysis was performed using the NCEL RDF Cost Model and site-specific boiler and cost data acquired from four naval activities that were determined to have the highest probability of successful co-firing. The cost effectiveness was measured by the savings-to-investment ratio (SIR) and computer over a range of cost and operating conditions to determine optimum RDF co-firing scenarios for each facility. Based on present laid-down coal costs and solid-waste disposal charges, no set of operating conditions could be identified wherein the use of either co-fired RDF-3 or RDF-5 could be economically justified. Volume I presents the report; This volume contains appendixes, and Volume III is the terminal manual of RDF cost model.

14014 **(AD-A—173982/0/XAB) RDF (refuse-derived fuel) co-firing cost/benefit analysis using the NCEL RDF Cost Model. Volume 3. RDF cost model manual. Final report, September 1985-August 1986.** Belencan; Smith. (Systech Corp., Xenia, OH (USA)). Aug 1986. 28p. NTIS, PC A03/MF A01.

The object of this effort was to determine the cost-effectiveness of co-firing RDF in existing Navy boilers. The cost-benefit analysis was performed using the NCEL RDF Cost Model and site-specific boiler and cost data acquired from naval activities that were determined to have the highest probability of successful co-firing. The cost-effectiveness was measured by the savings-to-investment ratio (SIR) and computed over a range of cost and operating conditions to determine optimum RDF co-firing scenarios for each facility. Based on present laid-down coal costs and solid-waste disposal charges, no set of operating conditions could be identified wherein the use of either co-fired RDF-3 or RDF-5 could be economically justified. Volume I presents the report; Volume II contains appendixes, and this volume is the terminal manual of RDF cost model.

14015 (CONF-8511246—, pp 72-76) **Development of a combustion system for three-gas-pass boilers up to 10 MW in order to reduce the NO/sub x/ content.** 1985. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE87751252.

From Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems; Hameln, F.R. Germany (4 Nov 1985).

It is reported about the NO/sub X/ reduction in the combustion of heavy fuel oil in a three-gas-pass boiler by measures at the burner (primary measures) and at the exhaust gas side (secondary measures). Primary measures were the reduction of the combustion temperature, the combustion space heat load and the partial pressure of oxygen. As secondary measures gaseous ammonia and aqueous ammonia solution were sprayed into the firing space. NO/sub X/ and also SO/sub 2/ emissions in the exhaust gas could be suppressed essentially. (HGOE).

14016 **(CONF-8604156—) Industrial combustion technologies.** Lukasiewicz, M.A. (ed.). (American Society for Metals, Metals Park, OH. Energy Div.; Gas Research Inst., Chicago, IL (USA); USDOE, Washington, DC; American Flame Research Committee). 1986. 328p. American Society for metals, Metals Park, OH 44073. File Number TI87004152.

From Symposium on industrial combustion technologies; Chicago, IL, USA (29 Apr 1986).

Separate abstracts were prepared for the individual papers in this report. (JDB)

14017 **(FRNC-TH—1895) Modelling of combustion chambers.** Mir, A. (Toulouse-3 Univ., 31 (France)). 1981. 163p. (In French). NTIS (US Sales Only), PC A08/MF A01. File Number DE87750973.

An experimental study of aerodynamics (without combustion) has been carried out on simplified models in order to study the organization of the flow in combustion chambers and to support modelling by combination of elementary centres. The one-dimensional model thus developed enables calculation of the distribution function of residence times and of the overall performance of the centre (efficiency of combustion and stability) in good agreement with hot experiments. 84 refs.

14018 (N—87-10377) **Demonstration of laser speckle system on burner liner cyclic rig. Final report.** Stetson, K.A. (United Technologies Corp., East Hartford, CT (USA)). Jun 1986. 28p. (NASA-CR—179509; NAS—1.26:179509; R—86-927298-10). NTIS, PC A03/MF A01.

A demonstration test was conducted to apply speckle photogrammetry to the measurement of strains on a sample of combustor liner material in a cyclic fatigue rig. A system for recording specklegrams was assembled and shipped to the NASA Lewis Research Center, where it was set up and operated during rig tests. Data in the form of recorded specklegrams were sent back to United Technologies Research Center for processing to extract strains. Difficulties were found in the form of warping and bowing of the sample during the tests which degraded the data. Steps were taken by NASA personnel to correct this problem and further tests were run. Final data processing indicated erratic patterns of strain on the burner liner sample.

14019 (N—87-11180) **Turbine engine hot section technology, 1984.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Oct 1984. 400p. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—). NTIS, PC A17/MF A01.

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Presentations were made concerning the hot section environment and behavior of combustion liners, turbine blades, and waves. The presentations were divided into six sessions: instrumentation, combustion, turbine heat transfer, structural analysis, fatigue and fracture, and surface properties. The principal objective of each session was to disseminate research results to date, along with future plans. Topics discussed included modeling of thermal and fluid flow phenomena, structural analysis, fatigue and fracture, surface protective coatings, constitutive behavior, stress-strain response, and life prediction methods.

14020 (N—87-11180, pp vp) **Combustion overview.** Schultz, D.F. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The objective of this effort is to develop improved analytical models of the internal combustor flow field and liner heat transfer as a means to shorten combustor development time and increase turbine engine hot section life. A four-element approach was selected to meet this objective. First, existing models were utilized to determine their deficiencies. Supporting research was then commenced to improve the exisiting models. While the research effort is in progress, the models are being refined to improve numerics and numerical diffusion. And lastly, the research results and improved numerics will be integrated into existing models.

14021 (N—87-11180, pp vp) **Laser anemometers of hot-section applications.** Seasholtz, R.G.; Oberle, L.G.; Weikle, D.H. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Laser anemometers are being developed for use in the turbine facilities at Lewis that are involved in the Turbine engine hot section technology Program. The status of the program is given along with some results accomplished since 1983.

14022 (N—87-11180, pp vp) **High temperature static strain gage program.** Hulse, C.; Bailey, R.; Grant, H. (Pratt and Whitney Aircraft, East Hartford, CT). Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Development of electrical resistance strain gages for static strain measurements of nickel or cobalt superalloy parts inside a gas turbine engine on a test stand was inititated. Measurements of this type are of great importance because without reliable knowledge of the stresses and strains which exist in specific components, it will be difficult to fully appreciate where improvements in design and materials can be implemented. The first part of this effort consists of a strain gage alloy development program which will be followed by an investigation of complete strain gage systems. Efforts to date are summarized.

14023 (N—87-11180, pp vp) **Evaluation results of the 700°C Chinese strain gages.** Hobart, H.F. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

There is a continuing interest and need for resistance strain gages capable of making static strain measurements on components located in the hot section of gas turbine engines. A paper by Tsentai Wu describes the development and evaluation of high temperature gauges fabricated from specially developed Fe-Cr-Al-V-Ti-Y alloy wire. Several of these gages and a quantity of P12-2 ceramic adhesive were purchased for evaluation. Nine members of the aircraft turbine engine community were invited to participate in an evaluation of these gages. Each participant was sent one strain gage, a small amount of ceramic adhesive, instructions for mounting the gage on a test beam, and a set of suggestions for the experiment. Data on gage factor variation with temperature, apparent strain, and drift are discussed.

14024 (N—87-11180, pp vp) **Demonstration test of burner liner strain measurements using resistance strain gages.** Grant, H.P.; Anderson, W.L. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

A demonstration test of burner liner strain measurements using resistance strain gages as well as a feasibility test of an optical speckle technique for strain measurement are presented. The strain gage results are reported. Ten Kanthal A-1 wire strain gages were used for low cycle fatigue strain measurements to 950 K and .002 apparent strain on a JT12D burner can in a high pressure (10 atmospheres) burner test. The procedure for use of the strain gages involved extensive precalibration and postcalibration to correct for cooling rate dependence, drift, and temperature effects. Results were repeatable within + or - .0002 to .0006 strain, with best results during fast decels from 950 K. The results agreed with analytical prediction based on an axisymmetric burner model, and results indicated a non-uniform circumferential distribution of axial strain, suggesting temperature streaking.

14025 (N—87-11180, pp vp) **Experimental verification of vapor deposition model in Mach 0.3 burner rigs.** Goekoglu, S.A. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

A comprehensive theoretical framework of deposition from combustion gases was developed covering the spectrum of various mass delivery mechanisms including vapor, thermophoretically enhanced small particle, and inertially impacting large particle deposition. Rational yet simple correlations were provided to facilitate engineering surface arrival rate predictions. Experimental verification of the deposition theory was validated using burner rigs. Toward this end, a Mach 0.3 burner rig apparatus was designed to measure deposition rates from salt-seeded combustion gases on an internally cooled cylindrical collector.

14026 (N—87-11180, pp vp) **Coating life prediction.** Nesbitt, J.A.; Gedwill, M.A. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Hot-section gas-turbine components typically require some form of coating for oxidation and corrosion protection. Efficient use of coatings requires reliable and accurate predictions of the protective life of the coating. Currently engine inspections and component replacements are often made on a conservative basis. As a result, there is a constant need to improve and develop the life-pre-

diction capability of metallic coatings for use in various service environments. The purpose of this present work is aimed at developing of an improved methodology for predicting metallic coating lives in an oxidizing environment and in a corrosive environment.

14027 (N—87-11180, pp vp) **Thermal barrier coating life prediction model development.** Strangman, T.E. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Thermal barrier coatings (TBCs) for turbine airfoils in high-performance engines represent an advanced materials technology that has both performance and durability benefits. In order to achieve these benefits, however, the TBC system must be reliable. Prediction of the lives of two types of strain-tolerant and oxidation-resistant TBC systems that are produced by commercial coating suppliers to the gas turbine industry is examined. The plasma sprayed TBC system, composed of a low-pressure plasma spray (LPPS) applied oxidation resistant NiCrAlY bond coating and an air-plasma-sprayed yttria (8 percent) partially stabilized zirconia insulative layer is applied by both Chromalloy and Klock. The second type of TBC is applied by the electron beam-physical vapor depositon (EB-PVD) process by Temescal.

14028 (N—87-11180, pp vp) **Thermal barrier coating life prediction model development.** Hillery, R.V. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

In order to fully exploit thermal barrier coatings (TBCs) on turbine components and achieve the maximum performance benefit, the knowledge and understanding of TBC failure mechanisms must be increased and the means to predict coating life developed. The proposed program will determine the predominant modes of TBC system degradation and then develop and verify life prediction models accounting for those degradation modes. The successful completion of the program will have dual benefits: the ability to take advantage of the performance benefits offered by TBCs, and a sounder basis for making future improvements in coating behavior.

14029 (N—87-11180, pp vp) **Thermal barrier coating life prediction model development.** Demasi, J.; Sheffler, K. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The objective of this program is to develop an integrated life prediction model accounting for all potential life-limiting Thermal Barrier Coating (TBC) degradation and failure modes including spallation resulting from cyclic thermal stress, oxidative degradation, hot corrosion, erosion, and foreign object damage (FOD). The mechanisms and relative importance of the various degradation and failure modes will be determined, and the methodology to predict predominant mode failure life in turbine airfoil application will be developed and verified. An empirically based correlative model relating coating life to parametrically expressed driving forces such as temperature and stress will be employed. The two-layer TBC system being investigated, designated PWA264, currently is in commercial aircraft revenue service. It consists of an inner low pressure chamber plasma-sprayed NiCoCrAlY metallic bond coat underlayer (4 to 6 mils) and an outer air plasma-sprayed 7 w/o Y_2O_3-ZrO_2 (8 to 12 mils) ceramic top layer.

14030 (N—87-11180, pp vp) **NASA dilution jet mixing, phase 3.** Srinivasan, R.; Myers, G.; White, C. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Many of the gas turbine combustors in operation use multiple rows of dilution jets, and some have geometries that are different from circular holes. The data base available in literature is generally applicable to a single row of circular holes. Tests were performed with uniform mainstream conditions for several orifice plate configurations. Temperature and pressure measurements were made in the test section at 4 axial and 11 transverse stations. These measurements were made with a 60-element rake probe. Test results for some of these cases are discussed.

14031 (N—87-11180, pp vp) **Flame radiation.** Wear, J.D. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Total radiation and heat flux data was obtained on a combustor liner by advanced instrumentation. If the results obtained by the special instrumentation are considered to be representative of the total radiation and heat flux, then the effect of variation of engine operating parameters and of fuel type can be more easily obtained. The special instrumentation used for these investigations consisted of five total radiometers and two total heat flux gages. The radiometers were arranged axially and circumferentially through sliding air seals in the outer liner. The two heat flux gages were welded in the outer liner between two circumferential radiometers. Static pressures were obtained on both the cold and the hot side of the outer liner in the area of the heat flux gages. Liner metal temperatures were also obtained. The combustor inlet pressure was varied over a nominal range of 0.5 to 2.07 MPa, inlet air temperature from 550 to 670 K, and fuel-air ratio from about 0.015 to 0.040. The two fuels tested were ASTM Jet A and a fuel designated as ERBS V. Results of the tests are discussed.

14032 (N—87-11180, pp vp) **3-D inelastic analysis methods for hot section components (base program).** Todd, E.S. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

A series of computer codes are sought that would permit more accurate and efficient three-dimensional inelastic structural analysis of combustor liners, turbine blades, and turbine vanes. Each code embodies a progression of mathematical models for increasingly comprehensive representation of the geometrical features, loading conditions, and forms of nonlinear material response that distinguish these three groups of hot section components.

14033 (N—87-11180, pp vp) **Creep fatigue life prediction for engine hot section materials (isotropic): two year update.** Moreno, V. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Requirements for increased durability of gas turbine hot section components have placed a greater degree of importance on accurate structural analysis and life prediction. Various life prediction approaches for high temperature applications were investigated. Basic models were selected and developed for simple-cycle, isothermal loading conditions. Models will be developed which address thermomechanical cycling, multiaxial conditions, cumulative loading, environmental effects, and cyclic mean stress. Verification tests of models will be conducted on an alternate material and coating system.

14034 (N—87-11180, pp vp) **Elevated temperature crack growth.** Kim, K.S.; Yau, J.F.; Vanstone, R.H.; Laflen, J.H. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Critical gas turbine engine hot section components such as blades, vanes, and combustor liners tend to develop minute cracks during early stages of operations. The ability of currently available path-independent (P-I) integrals to correlate fatigue crack propagation under conditions that simulate the turbojet engine combustor liner environment was determined. To date, an appropriate specimen design and a crack displacement measurement method were determined. Alloy 718 was selected as the analog material based on its ability to simulate high temperature behavior at lower temperatures in order to facilitate experimental measurements. Available P-I integrals were reviewed and the best approaches are being programmed into a finite element post processor for eventual compari-

son with experimental data. The experimental data will include cyclic crack growth tests under thermomechanical conditions, and, additionally, thermal gradients.

14035 (N—87-11180, pp vp) **Biaxial constitutive equation development.** Jordan, E.H.; Walker, K.P. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

In developing the constitutive equations an interdisciplinary approach is being pursued. Specifically, both metallurgical and continuum mechanics considerations are recognized in the formulation. Experiments will be utilized to both explore general qualitative features of the material behavior that needs to be modeled and to provide a means of assessing the validity of the equations being developed. The model under development explicitly recognizes crystallographic slip on the individual slip systems. This makes possible direct representation of specific slip system phenomena. The present constitutive formulation takes the anisotropic creep theory and incorporates two state variables into the model to account for the effect of prior inelastic deformation history on the current rate-dependent response of the material.

14036 (N—87-11180, pp vp) **Life prediction and constitutive models for engine hot section anisotropic materials.** Swanson, G.A. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The development of directionally solidified and single crystal alloys is perhaps the most important recent advancement in hot section materials technology. The objective is to develop knowledge that enables the designer to improve anisotropic gas turbine parts to their full potential. Two single crystal alloys selected were PWA 1480 and Alloy 185. The coatings selected were an overlay coating, PWA 286, and an aluminide diffusion coating, PWA 273. The constitutive specimens were solid and cylindrical; the fatigue specimens were hollow and cylindrical. Two thicknesses of substrate are utilized. Specimens of both thickness (0.4 and 1.5 mm) will be coated and then tested for tensile, creep, and fatigue properties.

14037 (N—87-11180, pp vp) **Turbine airfoil gas side heat transfer.** Turner, E.R. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Work is currently underway to develop and characterize an analytical approach, based on boundary layer theory, for predicting the effects of leading edge (showerhead) film cooling on downstream gas side heat transfer rates. Parallel to this work, experiments are being conducted to build a relevant data base for present and future methods verification.

14038 (N—87-11180, pp vp) **Measurement of airfoil heat transfer coefficients on a turbine stage.** Dring, R.P.; Blair, M.F. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The primary basis for heat transfer analysis of turbine airfoils is experimental data obtained in linear cascades. A detailed set of heat transfer coefficients was obtained along the midspan of a stator and a rotor in a rotating turbine stage. The data are to be compared to standard analyses of blade boundary layer heat transfer. A detailed set of heat transfer coefficients was obtained along the midspan of a stator located in the wake of a full upstream turbine stage. Two levels of inlet turbulence (1 and 10 percent) were used. The analytical capability will be examined to improve prediction of the experimental data.

14039 (N—87-11180, pp vp) **Gas flow environmental and heat transfer nonrotating 3D program.** Crawford, R.A. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

The experimental contract objective is to provide a complete set of benchmark quality data for the flow within a large rectangular turning duct. The data are to be used to evaluate and verify three-dimensional internal viscous flow models and computational codes. The analytical contract objective is to select such a computational code and define the capabilities of this code to predict the experimental results. Details of the proper code operation will be defined and improvements to the code modeling capabilities will be formulated.

14040 (N—87-11180, pp vp) **Assessment of a 3-D boundary layer code to predict heat transfer and flow losses in a turbine.** Anderson, O.L. Oct 1984. NTIS, PC A17/MF A01. (NASA-CP—2339; E—2267; NAS—1.55:2339; CONF-8410461—).

From Turbine engine hot section technology conference; Cleveland, OH, USA (23 Oct 1984).

Zonal concepts are utilized to delineate regions of application of three-dimensional boundary layer (DBL) theory. The zonal approach requires three distinct analyses. A modified version of the 3-DBL code named TABLET is used to analyze the boundary layer flow. This modified code solves the finite difference form of the compressible 3-DBL equations in a nonorthogonal surface coordinate system which includes coriolis forces produced by coordinate rotation. These equations are solved using an efficient, implicit, fully coupled finite difference procedure. The nonorthogonal surface coordinate system is calculated using a general analysis based on the transfinite mapping of Gordon which is valid for any arbitrary surface. Experimental data is used to determine the boundary layer edge conditions. The boundary layer edge conditions are determined by integrating the boundary layer edge equations, which are the Euler equations at the edge of the boundary layer, using the known experimental wall pressure distribution. Starting solutions along the inflow boundaries are estimated by solving the appropriate limiting form of the 3-DBL equations.

14041 **(PB—87-111159/XAB) Coal injection in an experimental blast furnace: a comprehensive reort. Open File report.** Woolf, P.L. (Woolf (Philip L.), Pittsburgh, PA (USA)). Aug 1985. 59p. NTIS, PC A04/MF A01.

Blast-furnace coal injection tests conducted by the Bureau of Mines in cooperation with a consortium of 22 steel companies in 1963-64 are described. These tests were part of a program of extensive investigation of auxiliary-fuel injection in the Bureau's experimental blast furnace located at Bruceton, PA. Seventeen coal tests are described on various coals ranging from anthracite to subbituminous. Factors affecting maximum rates of the injection were studied. These included coal size, coal type, and oxygen enrichment. The effect of high-sulfur-content coal and the means to control metal sulfur were investigated. An epilogue briefly describing the commercial experience with coal injection from 1960 to the present is included.

14042 **(PB—87-129250/XAB) Reactivity study of SO_2 control with atmospheric and pressure hydrated sorbents. Final report, May-October 1985.** Overmoe, B.J.; McCarthy, J.M.; Chen, S.L.; Seeker, W.R.; Pershing, D.W. (Energy and Environmental Research Corp., Irvine, CA (USA)). Nov 1986. 126p. NTIS, PC A07/MF A01.

The report gives results of a study to develop an understanding of the factors that control the reactivity of hydrated sorbents toward SO_2 in coal-fired furnaces. It focused on the impacts of hydrate properties (e.g., particle size, surface area, and chemical composition) and the furnace temperature of the injection location. A bench-scale hydrator was used to produce atmospheric and pressure-hydrated sorbents, with parameters pertinent to the hydration process varied. Study results indicate that pressure hydrates generated under well-controlled conditions are more reactive than commercially produced atmospheric hydrates. The important production and operating parameters for the pressure-hydration process included the size and composition of the quick-lime, the hydration temperature and pressure, the rate of water addition, and the pressure progression during discharge. All hydrates, atmospheric and pressure, exhibited a strong dependence on injection temperature.

14043 **(ESA-TT—59) Results of wind tunnel tests on external combustion.** Schaefer, B. (European Space Agency, 75 - Paris (France)). Dec 1985. Translated from Ergebnisse von Windkanalversuchen zur Aussenverbrennung (Cologne, West Germany). (DFVLR-FB—85-35; ETN—86-98245). 52p. NTIS, PC A04/MF A01; original German version available at DFVLR, Cologne, West Germany DM 56.

Wind tunnel tests on external combustion were carried out to study the flow distribution on a flat plate in a supersonic flow for spoiler optimization and combustion efficiency. The influence of spoiler geometry, mass flow rate and injection angle on flow distribution was studied. The separation area can be enlarged with the spoiler inclination against the flow. Resistance problems and mass flow rate against a split overture are reduced with a hole-line flow nozzle. The area of increased pressure is enlarged by injecting hydrogen in the recirculation area before the spoiler and by igniting the mixture. The cross force after ignition is five times as strong as the spoiler action.

4220 Underground Engineering

14044 **Cavities and tunnels in hard rock by thermal spallation.** Williams, R.E. (Los Alamos National Lab., NM). *Underground Space;* 9: No. 5-6, 273-275(1985).

Thermal spallation of hard rocks has been used commercially for many years to cut granite in quarries and to produce blast holes in taconite mines. It is an economical process for creating cavities in hard rocks, which are difficult to drill or mine by conventional methods. These cavities have great potential for storage of liquids and gases and for storage of energy in several forms. They may also be used as high-pressure, naturally heated retorts for certain chemical processes. The spallation process and the status of its development are described. The spallation equipment now being used and the equipment that needs to be developed are also discussed, as are the results of an economic study of the process.

4250 Power Cycles

14045 **(AD-A—173813/7/XAB) Stirling-engine external heat system design with heat-pipe heater. Final report, April 1984-December 1985.** Godett, T.M.; Ziph. (Stirling Thermal Motors, Inc., Ann Arbor, MI (USA)). Jul 1986. 114p. NTIS, PC A06/MF A01.

This final report presents the conceptual design of a liquid-fueled external-heating system (EHS), and the preliminary design of a heat-pipe heater for the STM-4120 Stirling-cycle engine, to meet the Air Force mobile electric power (MEP) requirement for units in the range of 20 to 60 kW. The EHS design had the following constraints: (1) Packaging requirements limited the overal system dimensions to about 330 mm x 250 mm x 100 mm; (2) Heat flux to the sodium heat pipe evaporator was limited to an average of 100 kW/m and a maximum of 550 kW/m based upon previous experience; (3) The heat-pipe operating temperature was specified to be 800 C based upon heat-input requirements of the STM4-120. An analysis code was developed to optimize the EHS performance parameters and an analytical development of the sodium heat-pipe heater was performed and both are presented and discussed. In addition, construction techniques were evaluated, and scale-model heat-pipe testing was performed.

14046 **(AD-A—174144/6/XAB) Compound-Cycle Engine program. Technical memo.** Bobula, G.A.; Wintucky, W.T.; Castor, J.G. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 23p. (NASA-E—3286). NTIS, PC A02/MF A01.

The Compound Cycle Engine (CCE) is a highly turbocharged, power-compounded power plant that combines the lightweight pressure-rise capability of a gas turbine with the high efficiency of a diesel. When optimized for a rotor-craft, the CCE will reduce fuel burned for a typical 2-hr (plus 30-min reserve) mission by 30% or more when compared to a conventional advanced-technology gas turbine. The CCE can provide a 50% increase in range payload product on this mission. A program to establish the technology base for a Compound-Cycle Engine is presented. The goal of this program is to research and develop those technologies that are barriers to demonstrating a multicylinder diesel core in the early 1990's. The major activity underway is a three-phased contract to perform: (1) a light-helicopter feasibility study, (2) component technology development, and (3) lubricant and material research and development. Other related activities are also presented.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

14047 **(ANU-P—935) Aging effects in the Canberra 14UD Pelletron.** Brinkley, T.A.; Clarkson, G.P.; Malev, M.D.; Ophel, T.R.; Turkentine, R.B.; Weisser, D.C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Jun 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780485.

Three problems associated with aging are discussed. The first is the failure of the ceramic disks in the column posts. Second is the spark erosion of metal components in the posts. And third is the cumulative deterioration of accelerator components associated with the use of a corona voltage distribution system as opposed to resistor grading.

14048 **(CONF-8610173—13) Operational experience for coupled operation of the Holifield tandem electrostatic accelerator and isochronous cyclotron.** Martin, J.A.; Dowling, D.T.; Haynes, D.L.; Hudson, E.D.; Jones, C.M.; Juras, R.C.; Lane, S.S.; Ludemann, C.A.; Meigs, M.J.; Milner, W.T. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 8p. NTIS, PC A02. File Number DE87003653.

From 11. conference on cyclotrons and their applications; Tokyo, Japan (13 Oct 1986).

Coupled operation of the 25 MV tandem accelerator and the Oak Ridge Isochronous Cyclotron of the Holifield Heavy Ion Research Facility began in January 1981. Since that time the use of the cyclotron in this mode has become routine. Thirty-six different ion species in the range from ^{9}Be to ^{150}Nd have been accelerated; 106 separate beam setups have been provided. Since the beginning of coupled operation, significant improvement of cyclotron systems, and setup and operating techniques, have been made. The graphite electrostatic deflector septum formerly used for high-current light ion beams has been replaced by a thin molybdenum septum. Extraction system positioning mechanisms have been refined and recalibrated and more precise and reliable position readouts have been provided. The computer-based control system has been improved. The frequency range of the rf system has been increased to eliminate an energy dead-band. Cyclotron setup calculations have been improved and standardized methods have been developed to consistently achieve well-centered orbits, correct beam extraction system positions, and electrostatic and magnetic strengths. A totally new beam bunching system has been installed. The improvements in the phase-lock system of the beam buncher have been especially effective. A large number of obsolete and unreliable power supplies have been replaced. Beam extraction efficiency has been increased from ~50% to ~70%. Accuracy of obtaining the desired energy without fine tuning is now ~1% compared to 2 to 3% in early coupled operation. Beam setup time (tuning) has been reduced by ~20%. Unscheduled maintenance has been reduced by a factor of two.

14049 **(CONF-8611103—2) Initial tests of compressed geometry acceleration tubes in the ORNL 25URC tandem accelerator.** Jones, C.M.; Erb, K.A.; Haynes, D.L.; Mitchell, J.T.; Ziegler, N.F.; Raatz, J.E.; Rathmell, R.D. (Oak Ridge National Lab., TN (USA); National Electrostatics Corp., Middleton, WI (USA)). 1986. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004401.

From 20. symposium of North Eastern Accelerator Personnel; Notre Dame, IN, USA (3 Nov 1986).

In an effort to further improve voltage performance of the ORNL 25URC accelerator, we are engaged in a program of replacing the original acceleration tubes with tubes of a compressed ge-

ometry design. In this design, which utilizes a modified NEC high-gradient 17-cm long tube section, the 3-cm thick heatable aperture assembly provided as part of the original installation is replaced with an aperture assembly of essentially zero length. This change has two beneficial effects. The first is that seven tube sections can be installed in the space previously occupied by six, thus increasing the effective insulator length per unit column length by a factor of 7/6 = 1.17. The second is that removal of the high-current feedthroughs which are an integral part of the heatable aperture assembly removes a source of vacuum leaks in the 25URC accelerator. The installation and tests described in this report represent the first of three phases of the tube replacement program for the 25URC accelerator. In this first phase, two 61-cm-long tube units were replaced with compressed geometry tubes. In the second phase, scheduled for October 1986, another seven units will be replaced. In the third phase, scheduled for August 1987, the final 18 units will be replaced. This sequential approach has been chosen to provide an opportunity to evaluate prototype designs before retrofitting the entire accelerator.

14050 **(DOE/SF/00515—T72) Stanford Linear Accelerator Center: Monthly report for December 1986.** (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 27 Jan 1987. Contract AC03-76SF00515. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003941.

Operational activities are reported for the month of December 1986 in the areas of accelerator and research operations, research area and experimental status, accelerator improvement program research division developments, and publications issued. (LEW)

14051 (KEK—85-6, pp 60-117) **Report of the studies on the e/sup +/e/sup -/ linear collider.** Yoshioka, M.; Yokoya, K.; Matsumoto, H.; Miyao, M. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Aug 1985. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. File Number DE87780047. (CONF-8503265—).

From Workshop on future plans for high energy physics; Oho, Ibaraki, Japan (25 Mar 1985).

The Linear Collider Study Group conceived the plans of a e/sup +/e/sup -/ linear collider in the TeV region and has proceeded with its design study. For the RF source a lasertron was examined in the course of research and development. For the purpose of further extending the efforts firmly, an overall design has been made of the 1 TeV x 1 TeV e/sup +/e/sup -/ linear collider. Boundary conditions in the design are the realization of 1 TeV x 1 TeV within this century, the power available up to 300 MVA, overall length up to 30 km, luminosity 10/sup 33/ cm/sup -2/sec/sup -1/, etc. Contents are the following: an outline of the linear collider, beam dynamics, accelerating tubes, microwave source, injector, final focussing system, detector. (Mori, K.).

14052 **(LA—10805-MS) Innovative concept for an advanced hadron facility based on a 2 GeV H^- linac.** Thiessen, H.A. (Los Alamos National Lab., NM (USA)). Jan 1987. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004771.

This report presents parameters for an innovative new concept for the design of an advanced hadron facility. We propose combining a cold neutron source with a kaon factory. We also discuss the possibility of a shared target for neutron and neutrino experiments. An initial cost estimate is presented.

14053 **(LBL—22554) History of proton linear accelerators.** Alvarez, L.W. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 14p. (CONF-860629—66). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003548.

From Linear accelerator conference; Stanford, CA, USA (2 Jun 1986).

Some personal recollections are presented that relate to the author's experience developing linear accelerators, particularly for protons. (LEW)

14054 **(SAND—86-2350) Safety training and safe operating procedures written for PBFA [Particle Beam Fusion Accelerator] II and applicable to other pulsed power facilities.** Donovan, G.L.; Goldstein, S.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1986. Contract AC04-76DP00789. 394p. NTIS MF A01. File Number DE87005213.

To ensure that work in advancing pulsed power technology is performed with an acceptably low risk, pulsed power research facilities at Sandia National Laboratories must satisfy general safety guidelines established by the Department of Energy, policies and formats of the Environment, Safety, and Health (ES & H) Department, and detailed procedures formulated by the Pulsed Power Sciences Directorate. The approach to safety training and to writing safe operating procedures, and the procedures presented here are specific to the Particle Beam Fusion Accelerator II (PBFA II) Facility but are applicable as guidelines to other research and development facilities which have similar hazards.

14055 **(LA-tr—87-4) Accelerator study note: An attempt of 1 GeV linac.** Kato, Takao. (Los Alamos National Lab., NM (USA); National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). 1987. Contract W-7405-ENG-36. Translation of ASN-259, 24 October 1986. 62p. NTIS, PC A04/MF A01. File Number DE87004642.

A hypothetical 1 GeV linac is described, including its structure (which includes an ion source, radio frequency quadrupole linac, drift type linac, and coupled cavity linac), criteria for optimized design, cost optimization, frequency dependability of high frequency electric power loss, tuning during operation, the general rf system, computer codes and example calculations, beam dynamics simulation, and reduction of energy spread through the use of a debuncher. (LEW)

14056 **Status of SLC.** Ecklund, S.D. (Stanford Linear Accelerator Center, CA). pp 958-967 of Annual meeting of the Division of Particles and Fields of the American Physical Society: proceedings of the Oregon meeting. Hwa, R.C. (ed.). Singapore; World Scientific Publishing Co. Pte. Ltd. (1986). (CONF-850869—). Contract AC03-76SF00515.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

The current construction status of the Stanford Linear Collider (SLC) is described along with a brief overview of the project. Tests of completed parts of the machine are summarized.

14057 **Accelerators for the study of many particle systems.** Alonso, J.R. (Lawrence Berkeley Lab., CA). pp 1001-1008 of Annual meeting of the Division of Particles and Fields of the American Physical Society: proceedings of the Oregon meeting. Hwa, R.C. (ed.). Singapore; World Scientific Publishing Co. Pte. Ltd. (1986). (CONF-850869—). Contract AC03-76SF00098.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

Higher energy accelerators continue to play an important role in nuclear physics, probing ever more deeply into the properties and behavior of the constituents of nuclear matter. Three main projectile-types currently used are electrons light hadrons (protons, mesons) and heavy ions; each addresses different aspects of the reaction process. Current and planned accelerators for each of these probes are discussed.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 13936

14058 **(AD-A—174586/8/XAB) Calculations of the formation and transport of high-quality, high-current relativistic electron beams. Final technical report, 1 August 1981-31 July 1985.** Thompson, J.R.; Sloan, M.L.; Moore, B.N.; Uglum, J.R. (Austin Research Associates, Inc., TX (USA)). Oct 1986. 239p. (I-ARA—86-U-44). NTIS, PC A11/MF A01.

This report reviews the results of calculations of the formation and transport of high quality, high-current relativistic electron beams. To have a well behaved injector diode without significant diode closure during the beam pulse, it is necessary to have a large-area cathode with a wide anode/cathode gap spacing. Introduction of electrodes to control the equipotential grading in the A-K gap was found to allow the formation and injection of a high quality, laminar, covergent beam into the Long Pulse Induction Linac (LPIL) transport system. By exercising a one-dimensional beam envelope code and a steady-state, two-dimensional beam-transport code, it was possible to obtain transport coil current settings to minimize current loss through the complex beam transport system. However, radial expansions and abrupt contraction in the conducting walls plus strong axial acceleration in the induction gaps of the accelerator were found to introduce perturbations to the radial beam forces that drive oscillations in the beam envelope. The largest radial oscillations were excited when the beam was injected into a strong solenoidal magnetic field to compress its size by an order of magnitude prior to transport into an FEL wiggler.

14059 **(BNL—38857) Summary of field quality data from SSC R and D dipoles.** Wanderer, P. (Brookhaven National Lab., Upton, NY (USA)). Jul 1986. Contract AC02-76CH00016. 6p. (CONF-8606215—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003475.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

The field quality data from the R and D SSC 4.5m-long dipoles are summarized and compared to SSC requirements. In most respects, the magnets exceed the requirements. Modifications incorporated into the 16.6m magnets are expected to correct the few deficiencies. Specific aspects of the magnet design are discussed in terms of their effect on particular multipoles and the time required for modifications.

14060 **(BNL—38965) Active internal corrector coils.** Thompson, P.A.; Cottingham, J.; Dahl, P.; Fernow, R.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Hahn, H.; Herrera, J. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 4p. (CONF-860583—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003478.

From International Committee for Future Accelerators workshop on superconducting magnets and cryogenics; Upton, NY, USA (12 May 1986).

Trim or corrector coils to correct main magnet field errors and provide higher multipole fields for beam optics purposes are a standard feature of superconducting magnet accelerator systems. This paper describes some of the design and construction features of powered internal trim coils and a sampling of the test results obtained.

14061 **(BNL—38974) Reduction of iron saturation in cosine theta dipoles.** Morgan, G. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 4p. (CONF-860583—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003487.

From International Committee for Future Accelerators workshop on superconducting magnets and cryogenics; Upton, NY, USA (12 May 1986).

A procedure is presented for systematically perturbing the circular iron aperture of a cosine-theta dipole in such a way as to postpone saturation effects up to the point where insufficient iron is present on the midplane. The resulting configuration has little loss in field compared to the alternative procedure of putting a large annulus between the coils and the iron. The necessary saturable iron program used was MDP, but the procedure could be performed with any program. The perturbation functions used to modify the iron shape provide good separation of effects so that only one perturbation per harmonic is needed, thus minimizing the amount of computation required. A coil and aperture configuration with low-field harmonic content approaching the stringent RHIC requirements is presented which requires no b_4 or higher order correction coils up to 4.1 T, with a good field aperture at low field of 32 mm and at 4.1 T, 30 mm. The b_2 correction required is largest at an intermediate field, and has a maximum amplitude of about -3.2. The transfer function of the configuration is about 2% higher than that of the reference design.

14062 **(BNL—38977) Accelerator dynamics and beam aperture.** Parsa, Z. (Brookhaven National Lab., Upton, NY (USA)). Oct 1986. Contract AC02-76CH00016. 19p. (CONF-850771—9). NTIS, PC A02/MF A01. File Number DE87003483.

From SLAC summer school on the physics of high energy particle accelerators; Stanford, CA, USA (15 Jul 1985).

We present an analytical method for analyzing accelerator dynamics, including higher order effects of multipoles on the beam. This formalism provides a faster alternative to particle tracking. Simplectic expressions for the emittance and phase describing the dynamical behavior of a particle in a circular accelerator are derived using second order perturbation theory (in the presence of nonlinear elements, e.g., sextupoles, octupoles). These expressions are successfully used to calculate the emittance growth, smear and linear aperture. Our findings compare well with results obtained from tracking programs. In addition perturbation to betatron tune; resonance strengths; stop bandwidth; fixed points; island width; and Chirikov criteria are calculated.

14063 **(BNL—39045) Determination of the linear aperture of the SSC [Superconducting Supercollider] clustered lattice used for the conceptual design report.** Dell, G.F. (Brookhaven National Lab., Upton, NY (USA)). 23 Jun 1986. Contract AC02-76CH00016. 7p. (CONF-8606215—25). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004179.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

A study is made of the linear aperture for the clustered lattice used for the SSC Conceptual Design Report. Random multipole errors are included in all magnetic elements including the insertion dipoles and quadrupoles. Based on the concept of smear, the linear aperture is equal to the dynamic aperture in the range $-0.1 \leqq \Delta P/P \leqq 0.03\%$. Strong coupling for $\Delta P/P > 0\%$ produces large smears. A variation of the smear parameter that is insensitive to coupling is proposed. A comparison is made with results reported in the SSC Conceptual Design Report.

14064 **(BNL—39047) The acceptance of the SSC [Superconducting Supercollider] clustered lattice.** Dell, G.F. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 2p. (CONF-8606215—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004177.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

The physical apertures of all elements of the SSC storage lattices are considered to determine whether correction of random multipole fields in the triplet quadrupoles is necessary when betatron amplitudes there are no more than the inner radius of the beam pipe. During computer simulated beam tracking the influence of random multiple fields was included as a kick given to the test particle at the center of each quadrupole and at the ends of every dipole. The degree of multipole correction needed is shown. (LEW)

14065 **(LBL—22208) Field quality of the end sections of SSC [Superconducting Super Collider] dipoles.** Hassenzahl, W.V.; Caspi, S.; Gilbert, W.; Helm, M.; Laslett, L.J.; Morgan, G.A. (Lawrence Berkeley Lab., CA (USA); Brookhaven National Lab., Upton, NY (USA)). Sep 1986. Contract AC03-76SF00098;AC02-76CH00016. 8p. (CONF-860914—23). NTIS, PC A02. File Number DE87003534.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The central or two-dimensional field of a dipole magnet can be calculated with some precision. The fields at the end of the magnet, which are three-dimensional in nature, provide a more complicated problem. Starting with an end design that produced a relatively good end in terms of multipole components, a method of extending parts of the straight section was used to reduce the most important harmonics, the sextupole and decapole, to a negligible level. In addition, the effect of extending an iron yoke over the ends of a magnet was investigated and it was found to have little

effect on the harmonics, though it will raise the dipole field. These results are encouraging as they imply that good ends can be developed with relative ease should the two dimensional cross-section of a dipole magnet such as the SSC have to be changed.

14066 **Collective focusing of intense nonrelativistic ion beams by co-moving electrons.** Krafft, G.A. Berkeley, CA; Univ. of California (1986). 139p. University Microfilms Order No. 86-24,821.

Thesis (Ph. D.).

For an intense ion beam, the following power of a solenoid magnet may be increased by many orders of magnitude by adding co-moving electrons. In this type of magnetic lens, the ions are focused by a collective electrostatic field induced in the beam by the action of the solenoid on the electrons. In this thesis, the collective field in such a lens is calculated using linearized perturbation theory and particle-in-cell computer simulation. The dependence of the collective field on the temperature of the neutralizing electrons is investigated using both of these methods and the effects of an applied electric field are included in the calculations. In addition, perturbation calculations of the effects of various errors are presented, including a linear stability analysis of the flow when the beam is in the lens. The results of a proof of principle experiment employing the large contact ionization Cs^{+1} source at LBL are given. The major finding is that the collective lens focuses the beam, but electron thermal effects distort the space charge field. The simulations give a good quantitative account of the experimental results. The thesis concludes with a discussion of applications.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 14010, 14060, 14143, 14162, 14162, 15091, 15092, 15093, 15094, 15095, 15096, 15097, 15098, 15099, 15100, 15101

14067 **(BNL—38852) Construction of cold mass assembly for full-length dipoles for the SSC [Superconducting Super Collider] accelerator.** Dahl, P.; Cottingham, J.; Garber, M.; Ghosh, A.; Goodzeit, C.; Greene, A.; Herrera, J.; Kahn, S.; Kelly, E.; Morgan, G. (Brookhaven National Lab., Upton, NY (USA)). Oct 1986. Contract AC02-76CH00016. 4p. (CONF-860914—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003488.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

Four of the initial six 17m long demonstration dipole magnets for the proposed Superconducting Super Collider have been constructed, and the first one is now being tested. This paper describes the magnet design and construction of the cold mass assembly. The magnets are cold iron (and cold bore) 1-in-1 dipoles, wound with partially keystoned current density-graded high homogeneity NbTi cable in a two-layer cos θ coil of 40 mm inner diameter. The magnetic length is 16.6 m. The coil is prestressed by 15 mm wide stainless steel collars, and mounted in a circular, split iron yoke of 267 mm outer diameter, supported by a cylindrical yoke (and helium) containment vessel of stainless steel. The magnet bore tube assembly incorporates superconducting sextupole trim coils produced by an industrial, automatic process akin to printed circuit fabrication.

14068 **(BNL—38854) Anomalous low field magnetization in fine filament NbTi conductors.** Ghosh, A.K.; Sampson, W.B.; Gregory, E.; Kreilick, T.S. (Brookhaven National Lab., Upton, NY (USA); Supercon, Inc., Shrewsbury, MA (USA)). Oct 1986. Contract AC02-76CH00016. 5p. (CONF-860914—25). NTIS, PC A02. File Number DE87003473.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The first cable conductors for SSC were made with NbTi filaments whose diameters were in the 18 to 23 micron range. In an effort to reduce the magnetization effects in accelerator dipoles resulting from these large filaments, second generation conductors are now being manufactured with much smaller filaments. As part of this development a series of NbTi conductors were made with filament diameters ranging from 8.0 to 2.8 μm and having an average interfilament spacing of approximately 12% of filament diameter. Measurements at 4.3 K show that as the filament spacing decreases below a certain critical value the low field magnetization increases rapidly. This increase is seen to be strong function of interfilament distance, magnetic field and temperature. Details of these measurements and its implication for practical high current SSC wire design are discussed.

14069 **(BNL—38855) Results from heater-induced quenches of A 4.5 m Reference Design D dipole for the SSC.** Ganetis, G.; Prodell, A. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 5p. (CONF-860914—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003474.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

Quench studies were performed using a 4.5 m long Reference Design D, SSC dipole to determine the temperature rise of the magnet conductor during a quench by measuring the resistance of the conductor cable in the immediate vicinity of the quench. The single bore magnet was wound with improved NbTi conductor in a 2-layer cosine θ coil configuration of 4.0 cm inner diameter. Eight pairs of voltage taps were installed at various locations on the right side of the inner coil of the magnet. "Spot" heaters were centrally located between the voltage taps of 4 of these pairs on the midplane turn of the inner coil to initiate magnet quenches. A redundant array of voltage taps and heaters was also installed on the left side of the inner coil. The resistance of the conductor was obtained from observations of the current and voltage during a magnet quench. The temperature of the conductor was then determined by comparing its resistance to an R vs T curve appropriate for the conductor. The quantity $\int I^2dt$ and the temperature, T, are presented as a function of current, and the maximum conductor temperature is shown as a function of $\int I^2dt$. Measured longitudinal and azimuthal quench propagation velocities are also presented as a function of magnet current, and the temperatures at several locations on the inner magnet coil are plotted as a function of the time after a quench was initiated.

14070 **(BNL—38966) Magnets for RHIC [Relativistic Heavy Ion Collider].** Willen, E.H. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 6p. (CONF-860583—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003486.

From International Committee for Future Accelerators workshop on superconducting magnets and cryogenics; Upton, NY, USA (12 May 1986).

The magnet system for the Relativistic Heavy Ion Collider (RHIC) at Brookhaven is briefly described. The basic layout of the RHIC and a regular arc cell are shown, and the layout of the magnets to bring the beams into collision is described. The characteristics of the dipole and quadrupole magnets required for the arcs and intersection regions are given. The research and development effort has focused on the arc dipoles, and the current dipole design is shown. Magnet performance characteristics are reported. The arc quadrupole design and characteristics are given. (LEW)

14071 **(BNL—38968) Procedures for measuring the electrical properties of superconductors for accelerator magnets.** Sampson, W.B. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 5p. (CONF-860583—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003477.

From International Committee for Future Accelerators workshop on superconducting magnets and cryogenics; Upton, NY, USA (12 May 1986).

There are three important electrical properties associated with the superconductor used to fabricate accelerator magnets. The most important is the critical current since this determines the performance potential of the magnet. The normal state resistivity and the volume magnetization are the other principal electrical parameters. In this report methods for measuring these parameters are presented and procedures for including self field effect and magnetoresistance are discussed.

14072 **(BNL—51959) Construction and commissioning of dedicated synchrotron radiation facilities: Proceedings of workshop.** (Brookhaven National Lab., Upton, NY (USA)). Oct 1985. Contract AC02-76CH00016. 249p. (CONF-8510357—). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE87004151.

From Workshop on the construction and commissioning of dedicated synchrotron radiation facilities; Upton, NY, USA (16 Oct 1985).

Separate abstracts were prepared for 21 papers in these workshop proceedings. (LEW)

14073 **(CONF-8610173—11) Vacuum measurements of the K500 cyclotron accelerator chamber.** Mallory, M.L.; Miller, P.S.; Kuchar, J.; Hudson, E.D. (Oak Ridge National Lab., TN (USA); Michigan State Univ., East Lansing (USA). Cyclotron Lab.). 1986. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004269.

From 11. conference on cyclotrons and their applications; Tokyo, Japan (13 Oct 1986).

To evaluate the effectiveness of the unique internal cryopumping system, the pressure in the K500 superconducting cyclotron was measured as a function of radius for various gas flow rates emanating from the internal PIG source. For the test, a nude ion gauge with vertical dimension less than 2.3 cm was built and mounted on the internal beam probe. The effect of magnetic field on the ion gauge reading was determined and a method of degaussing the cyclotron was devised. Data from the normal shielded ion gauge located approximately 6 m away from the median plane was correlated with the internal vacuum measurements.

14074 **(CONF-8611103—3) A novel method for measuring beam energies by time-of-flight.** Olsen, D.K.; Erb, K.A.; Jones, C.M.; Milner, W.T.; Ziegler, N.F. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004197.

From 20. symposium of North Eastern Accelerator Personnel; Notre Dame, IN, USA (3 Nov 1986).

A novel time-of-flight (TOF) technique is reported for the measurement of ion beam energies. This technique was used, along with a more conventional nuclear reaction technique, to measure the calibration function of the Holifield Heavy Ion Research Facility tandem accelerator energy-analyzing magnet. The technique to be described is based on the use of a variable frequency buncher and two identical capacitive pickup units (CPU) to measure the velocity of ions selected by the energy-analyzing magnet. The CPUs were separated by a distance of 6166.2 +- 0.4 mm and were connected by equal length cables to wide band HP-8447F preamplifiers which in turn were connected to a dual trace oscilloscope. The beam was bunched using the first harmonic element of the double-drift bunching system which is located in the tandem accelerator injection line.

14075 **(CONF-8611103—4) Charging and corona modifications to the ORNL 25URC accelerator.** Ziegler, N.F.; McPherson, R.L. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004396.

From 20. symposium of North Eastern Accelerator Personnel; Notre Dame, IN, USA (3 Nov 1986).

A chain-charge monitoring system was first installed in the 25URC accelerator in October 1982, and has provided valuable information about the charging system. Additions to the system during the past year have significantly increased the amount of information provided by the monitor. Cables connecting pickoff wheels and inductors in the terminal were improved to provide higher reliability of the charging system. The tube corona points supplied with the 25URC accelerator had a point-to-plane spacing of 0.175 inches. Our operating experience indicated that the corona currents for the normal gas pressure and voltage range of the accelerator were lower than optimum. Current-voltage characteristics of a three-needle point set were measured at several spacings and gas pressures to provide criteria for ordering new points.

14076 (INIS-SU—392, pp 406) **System for stabilization of betatron operating mode.** Belyaev, S.N.; Kozin, A.B.; Semenov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14077 (INIS-SU—392, pp 397) **Possibility of gas-dynamic target efficiency increase.** Komarov, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14078 (INIS-SU—392, pp 400) **Accelerated ion beam shaping for nuclear spectroscopy.** Arzumanov, A.A.; Voronin, A.M.; Gor'kovets, M.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14079 (INIS-SU—392, pp 401) **Isotope targets from ten to hundered μm for nuclear studies.** Zaritskij, V.S.; Stepanenko, V.A.; Slyusarenko, L.I.; Zheltonozhskij, V.A.; Onoshko, N.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14080 (INIS-SU—392, pp 403) **Thin carbon films.** Kozeratskaya, G.N.; Stepanenko, V.A.; Zaritskij, V.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14081 **(LBL—21296) The effects of filament magnetization in superconducting magnets as calculated by POISSON.** Caspi, S.; Gilbert, W.S.; Helm, M.; Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract AC03-76SF00098. 6p. (CONF-860914—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003552.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

Magnetization of superconducting material can be introduced into POISSON through a field dependent permeability table (in the same way that iron characteristics are introduced). This can be done by representing measured magnetization data of the increasing and decreasing field by two independent B-γ curves ($\gamma = 1/\mu$). Magnetization curves of this type were incorporated into the current regions of the program POISSON and their effect on the field coefficients observed. We have used this technique to calculate the effect of magnetization on the multipole coefficients of a SSC superconducting dipole magnet and to compare these coefficients with measured values.

14082 **(LBL—21758) Pulser development for MBE-4.** Gough, D.E.; Brodzik, D.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1986. Contract AC03-76SF00098. 9p. (CONF-860674—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003547.

From 17. power modulator symposium; Seattle, WA, USA (23 Jun 1986).

The Multiple Beam Experiment MBE4 is designed to accelerate four cesium ion beams from 200 kV to about 1 MV using an induction linac and to demonstrate the process of current amplification simultaneously with acceleration. The injected beam is obtained from a source using a Marx generator providing typically 10 mA/beam with a length of 1.6 meters. This is equivalent to a beam duration time of about 3 μsec. Twenty four acceleration gaps in groups of four are distributed along the length of the machine which will be some 16 meters long when completed. Each group of

four acceleration gaps with appropriate quadrupoles form one section of the machine, identified as A through F. Careful tailoring of the acceleration voltage waveforms at each gap is required to accelerate the beam, amplify the current and provide longitudinal focusing. Ideal voltage waveforms for each gap were generated for a gap voltage limit initially set at 30 kV. These waveforms are shown in Fig. 1. The waveforms for the first 4 gaps are triangular with an approximate width of 3 μsec, becoming flatter and shorter at subsequent gaps as the beam bunch velocity increases. Ninety two nickel-iron tape wound cores capable of 6.8 mVsec/core and twenty six silicon steel tape wound cores capable of 24 mVsec/core were available. Groups of cores at the first eight gaps have been used in conjunction with an appropriate number of pulsers to provide the necessary accelerating voltage waveforms together with the pulser waveforms at every fourth acceleration gap which provides the longitudinal focusing of the beam. This paper will deal with the performance of the pulsers for the first eight gaps of acceleration and expectations for the next four, currently under construction.

14083 **(LBL—22333) A high-charge-state plasma neutralizer for an energetic H^- beam.** Schlachter, A.S.; Leung, K.N.; Stearns, J.W.; Olson, R.E. (Lawrence Berkeley Lab., CA (USA); Missouri Univ., Rolla (USA)). Oct 1986. Contract AC03-76SF00098. 13p. (CONF-8610115—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003551.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

A high-charge-state plasma neutralizer for a beam of energetic H^- ions offers the potential of high optimum neutralization efficiency (~85%) relative to a gas target (50 to 60%), and considerably reduced target thickness. We have calculated cross sections for charge-changing interactions of fast H^- and H^0 in collision with highly charged ions using a semiclassical model for H^-, and the Classical-Trajectory Monte Carlo method plus Born calculations, to obtain correct asymptotic cross sections in the high-energy limit. Charge-state fractions as a function of plasma line density, and f0/sup max/, the maximum H^0 fraction, are calculated using these cross sections; we find that f0/sup mx/ ≅ 85% for ion charge states in the range 1+ to 10+, and that target ion line density for f0/sup max/ decreases approximately as the square of the plasma ion charge state. The maximum neutral fraction is also high for a partially ionized plasma. We have built a small multicusp plasma generator to use a a plasma neutralizer; preliminary results show that the plasma contains argon ions with an average charge state between 2+ and 3+ for a steady-state discharge.

14084 **(LBL—22385) Characteristics of a small multicusp H^- source.** Ehlers, K.W.; Leung, K.N.; Pyle, R.V.; Kunkel, W.B. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 10p. (CONF-8610115—13). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003537.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

It is shown that the H^- current extracted from a magnetically filtered multicusp source can be enhanced by optimizing the extraction chamber length, by employing the proper chamber wall material, by mixing hydrogen with xenon gases in the discharge and by injecting very low energy electrons into the filter and extraction regions. A large improvement in H^- yield can be achieved by using a multicusp source with a much reduced plasma volume. In this arrangement, H^- current densities as high as 240 mA/cm^2 have been obtained from a 1-mm-diam extraction aperture.

14085 **(SAND—85-1517) Experimental verification of bremsstrahlung dosimetry predictions for 0.75 MeV electrons.** Halbleib, J.A.; Sanford, T.W.L.; Beezhold, W. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1986. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE87004776.

Bremsstrahlung dose in CaF_2 TLDs from the radiation produced by 0.75 MeV electrons incident on Ta/C targets is measured and compared with that calculated via the CYLTRAN Monte Carlo code. The comparison was made to validate the code, which is used to predict and analyze radiation environments of flash x-ray simulators measured by TLDs. Over a wide range of Ta target thicknesses and radiation angles, the code is found to agree with the 5% measurements. For Ta thickness near those that optimize the radiation output, however, the code overestimates the radiation dose at small angles. Maximum overprediction is about 14 +- 5%. The general agreement, nonetheless, gives us confidence that the TLD calibration procedure is satisfactory and that the code performs well at this energy. For the bulk of the measurements, a standard TLD employing a 2.2 mm thick Al equilibrator was used. In this paper, we also show that this thickness can significantly attenuate the free-field dose and introduce significant photon buildup in the equilibrator.

14086 **(SLAC-PUB—3971) High-field capture section for SLC positron source.** Hoag, H.A.; Deruyter, H.; Kramer, J.; Yao, C.G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1986. Contract AC03-76SF00515. 4p. (CONF-860629—67). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004565.

From Linear accelerator conference; Stanford, CA, USA (2 Jun 1986).

The positron source for SLC is being installed at the two-thirds point on the SLAC linac. Electron bunches at 33 GeV impinge upon a Tantalum/Tungsten target, producing showers of positrons with energies extending from approximately 2 to 20 MeV, with most positrons at the low end of this range. Positrons with low energies and finite transverse momenta slip phase during the processes of reacceleration and reinjection into the SLC system, increasing the energy spread and reducing the overall yield of the positron source. This reduction in yield has to be minimized by "capturing" the positrons with a high-field accelerator section placed as soon after the target as possible. The design, fabrication and RF testing of this accelerator section are described.

14087 **(TRI-PP—86-91) Improved reliability of the TRIUMF resonator system through installation of new resonator panels.** Worsham, R.; Dohan, D.; Dutto, G.; Fong, K.; Poirier, R.; Stanford, G. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 4p. (CONF-8610173—12). NTIS (US Sales Only), PC A02. File Number DE87900407.

From 11. conference on cyclotrons and their applications; Tokyo, Japan (13 Oct 1986).

The rf resonator of the TRIUMF cyclotron is being upgraded with newly designed resonator segments. In addition to having higher dynamic stability and an adjustable ground-arm geometry, these segments also contain modified water-cooling circuits and thermally isolated strongbacks. The heat from resistive rf losses inside the resonator cavity as well as that from leakage into the beam cavity is removed efficiently, eliminating mechanical distortions and instability caused by differential thermal expansion. Improvements in the water circulation pattern have reduced flow-induced vibrations. Nine new resonator segments were installed in locations at which the power dissipation was observed to be substantial. The location of maximum power dissipation is controlled by adjusting the tip capacity of individual segments, which alters the leakage pattern in the beam cavity to maintain the peak dissipation on these particular water-cooled segments. Remote ground arm tip control was installed to accomplish this without interrupting beam operation.

14088 **Initial operation of the Fermilab antiproton source.** Holmes, S.D. (Fermi National Accelerator Lab., Batavia, IL). pp 949-957 of Annual meeting of the Division of Particles and Fields of the American Physical Society: proceedings of the Oregon meeting. Hwa, R.C. (ed.). Singapore; World Scientific Publishing Co. Pte. Ltd. (1986). (CONF-850869—).

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

The Fermilab Tevatron I (TeV I) project has as its prime objective initiation of proton-antiproton collisions at 2.0 TeV in the center-of-mass, with a luminosity of 1030 cm^{-2} sec^{-1} by September 1, 1986. The two components needed to produce such collisions are the Fermilab 1 TeV (Tevatron) accelerator and the Antiproton Source. The Fermilab Tevatron has been in operation for more

than a year providing high energy protons for fixed target experiments while the Antiproton Source is currently being commissioned. Progress made so far in the commissioning of the source has encouraged us to form an intermediate goal of observing proton-antiproton collisions in the Tevatron before the scheduled Shutdown in October, 1985.

14089 **Soft X-ray microscopy at the NSLS.** Kenney, J.M.; Kirz, J.; Rarback, H.; Howells, M.R. (SUNY, Stoney Brook). *Nuclear Instruments and Methods in Physics Research;* 222: 37-41(1984). Contract AC02-76CH00016.

From 3. National conference on synchrotron radiation instrumentation; Upton, NY, USA (12-14 Sep 1983).

The U15 beamline at the NSLS has been instrumented for various forms of soft X-ray imaging. A toroidal grating serves as the monochromator and as the optical element that images the source onto the exit slit. Thin contamination barriers separate the UHV region from an intermediate vacuum region and from the atmospheric environment. The scanning microscope uses a Fresnel zone plate to demagnify a 30 μm aperture located near the exit slit 100 x to form a 0.3 μm focal spot through which the specimen is scanned under computer control. The electron-beam fabricated zone plate has 1500 A wide outer zones and a 5 mm focal length at 32 A. The focus is in the atmospheric environment. X-rays transmitted by the specimen are detected with a flow proportional counter, and the image is displayed on a television screen. Other forms of imaging take place in the intermediate vacuum environment. For contact microscopy an array of specimen-resist sandwiches are mounted on a manipulator and exposed in sequence. For tests of in-line Fresnel holography a camera is attached to the beamline which includes a collimator, the specimen and photographic film. Feasibility tests of soft X-ray diffraction are carried out using another camera, with particular attention to the detection of X-rays diffracted at large angles. The authors describe the performance of the apparatus, present some of the first results, and describe plans for the future. 18 references, 5 figures.

4304 Storage Rings

14090 **Very high energy polarized beams for the SSC.** Makdisi, Y.I. (Brookhaven National Lab., Upton, NY). pp 992-1000 of Annual meeting of the Division of Particles and Fields of the American Physical Society: proceedings of the Oregon meeting. Hwa, R.C. (ed.). Singapore; World Scientific Publishing Co. Pte. Ltd. (1986). (CONF-850869—).

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

This talk represents a summary of the Workshop on Polarized Protons at the SSC that was held from June 10-15, 1985, in Ann Arbor, Michigan. The workshop dealt with a number of topics divided along functional hardware lines in addition to those addressed by the theory group. Periodically all the groups met together to discuss common issues that transcended their division. The main topics were: spin-physics and motivation; booster I (1-70) GeV; booster II (70 GeV-1 TeV); the main ring (1-20) TeV; polarimeters; and demonstration snake.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 13909, 14405, 14630

14091 **(AD-A—173721/2/XAB) Employment of a ^{3}He-based fast-neutron spectrometer to augment the DREO (Defence Research Establishment Ottawa) radiation-measurement system.** Cousins, T. (Defence Research Establishment, Ottawa, Ontario (Canada)). Oct 1985. 25p. (DREO—935). NTIS, PC A02/MF A01.

The major radiation spectrometer for the measurement of both free field and in-vehicle field was until recently the NE213 liquid scintillator. In the area of neutron spectroscopy the poor energy resolution and relatively high lower-energy threshold are this spectrometer's major drawbacks. With a view to circumventing these problems, DREO recently decided to augment its neutron spectroscopy system with a ^{3}He-based ionization chamber. This report describes the advantages of this detector and outlines the methodology used to generate the energy-dependent response matrix necessary for spectral unfolding. Finally, the unfolded spectra from various radiation sources are presented and compared with theory and other experimental results.

14092 **(AREAEE—278) Moessbauer effect spectrometer.** Fayek, M.K.; Abbas, Y.M.; Bahgat, A.A. (Nuclear Research Centre, Inshas (Egypt)). 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780491.

A Moessbauer effect spectrometer of Harwell type is installed and put in operation. The driving system is of a constant acceleration mode with a velocity range 40mm/sec and associated to a 1024 multichannel analyzer working in a multiscalar time mode. The gamma ray sources are 50 mCi Co^{57} in Pd and 20 mCi Sn/sup 119m/ in Ba Sn(O)$_3$. Measurements are taken with the source kept at room temperature, while the absorber can be maintained at various temperatures. Gamma ray resonance spectra of different standard samples are obtained. Zero velocity and magnetic field calibration curves are deduced. Examples of some Moessbauer spectra for running investigated materials with a comprehensive general description are also given.

14093 **(AREAEE—281) Pulse shape discrimination set-up and investigation of n-γ discrimination.** Megahid, R.M.; Ismail, M.S.; Kamel, S.A. (Nuclear Research Centre, Inshas (Egypt)). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780493.

A method which is based upon a measurement of the zero crossing time for signals produced by RC differentiation of dynode voltage pulses. The circuit utilizes the signal from a suitably chosen dynode (i.e., linear signal) and the anode signal as a time reference signal. The latter is used to generate a signal for use in coincidence circuitry and as a time marker signal for use in PSD. The discrimination capability and energy scaling of the system was checked by measuring the neutron and gamma spectra emitted from a pu-α-Be neutron source. These spectra were analyzed and results indicate that, the discrimination capability, noise rejection and pulse pile-up rejection are good over a range of amplitude corresponding to recoil protons of 1.5 to 10 MeV energy.

14094 **(CERN—85-15) FASTBUS software workshop: proceedings.** (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Nov 1985. 176p. (CONF-8509189—). NTIS (US Sales Only), PC A09/MF A01. File Number DE86780495.

From CERN FASTBUS software workshop; Geneva, Switzerland (23 Sep 1985).

FASTBUS is a standard for modular high-speed data acquisition, data-processing and control, development for use in high-energy physics experiments incorporating different types of computers and microprocessors. This Workshop brought together users from different laboratories for a review of current software activities, using the standard both in experiments and for test equipment. There are also papers on interfacing and the present state of systems being developed for use in future LEP experiments. Also included is a discussion on the proposed revision of FASTBUS Standard Routines.

14095 **(CONF-870601—4) Source of correlated noise in experiments using a ^{252}Cf source.** Difilippo, F.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. File Number DE87004422.

From Annual meeting of the American Nuclear Society; Dallas, TX, USA (7 Jun 1987).

The ^{252}Cf source method to measure reactivities is under intensive study, both theoretical and experimentally, at the Oak Ridge National Laboratory. The method was already applied to a large variety of multiplicative systems ranging from thermal to fast, homogeneous to heterogeneous and continuous to discrete. Potential applications to the measurement of very large subcriticalities require a careful analysis of the source of correlated noise. Still, ^{252}Cf

experiments are analyzed by applying the Schottky prescription of the source of noise without corrections due to the neutrons removed by the detector; this is equivalent to assuming that detectors' fluctuations are exactly proportional to the fluctuation of the neutron field. Sheff and Albrecht emphasized later that the Schottky source of noise has to be divided into two components related respectively to multiple neutrons per event (fission) and to a single neutron per event (absorption plus leakage), and that only the first component is the source of correlated noise for the detector. The differences between the two formalisms have very practical implications when the ^{252}Cf method is applied to measure large subcriticalities. This paper analyzes systems without multiplication in order to emphasize the differences; also additional sources of correlations due to finite resolution time are individualized and quantified. Whenever possible, a master equation approach is used to avoid a posteriori cosmetic to the Langevin/Schottky approach. 5 refs., 1 fig.

14096 **(FNAL/C—86/157) Personal dosimetry in a mixed field of high energy muons and neutrons.** Cossairt, J.D.; Elwyn, A.J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1986. Contract AC02-76CH03000. 10p. (CONF-870219—7). NTIS, PC A02. File Number DE87003853.

From Midyear topical symposium of the Health Physics Society: health physics of radiation-producing machines; Reno, NV, USA (8 Feb 1987).

High energy accelerators quite often emit muons. These particles behave in matter as would heavy electrons and are thus difficult to attenuate with shielding in many situations. Hence, these muons can be a source of radiation exposure to personnel and suitable methods of measuring the absorbed dose received to these people is obviously required. In practical situations, such muon radiation fields are often mixed with neutrons, well-known to be an even more troublesome particle species with respect to dosimetry. In this paper, we report on fluence measurements made in such a mixed radiation field and a comparison of dosimeter responses. We conclude that commercial self-reading dosimeters and film badges provided an adequate measure of the absorbed dose due to muons.

14097 **(INIS-BR—445) Betaradiography, a nondestructive test to examine papers and materials of small thickness.** Daltro, T.F.L.; Banados Perez, H.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1985. 16p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780515.

A description of the betaradiography is presented, showing its physical principles, materials, methods and some uses.

14098 (INIS-mf—10100, pp 33) **Use of computers at the verification of dosemeters.** Jakab, A.; Peter, M.; Szoerenyi, A. (National Office of Measures, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14099 (INIS-mf—10100, pp 48) **Ten years experience with a large computerized TLD-personnel monitoring service.** Duftschmid, K.E. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14100 (INIS-mf—10100, pp 49) **Computer aided evaluation of thermoluminescence dosimeters in routine control of occupationally exposed persons.** Brunner, P.; Bobleter, O. (Innsbruck Univ., Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14101 (INIS-mf—10100, pp 24) **New low-level laboratory of the 'Bundesversuchs- und Forschungsanstalt Arsenal' Wien.** Aiginger, H.; Unfried, E.; Maringer, F.; Rank, D.; Nemet, J. (Atominstitut der Oesterreichischen Universitaeten, Vienna; Bundesversuchs- und Forschungsanstalt Arsenal, Vienna, Austria; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14102 (INIS-mf—10100, pp 30) **Z80 microprocessor based subroutine system for evaluating nuclear track detectors.** Palfalvi, J.; Durrani, S.A. (Hungarian Academy of Sciences, Budapest; Birmingham Univ., England). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14103 (INIS-mf—10100, pp 35) **Microprocessor based radiation monitor with extended possibilities.** Drndarevic, V.R.; Milic, A.B.; Koturovic, A.M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14104 (INIS-mf—10100, pp 38) **Environmental gamma radiation monitoring system with a large volume air ionization chamber.** Duftschmid, K.E.; Strachotinsky, C.; Witzani, J. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14105 (INIS-mf—10100, pp 42) **TLD-04B interfaced with an HP-41CV.** Zarand, P.; Szabo, B. (Weil Emil Korhaz-Rendeloeintezet, Budapest, Hungary; National Office of Measures, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14106 (INIS-mf—10100, pp 31) **Fast neutron spectrometer based on Cr-39 proton sensitive track detector.** Dajko, G. (Magyar Tudomanyos Akademia, Debrecen, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14107 (INIS-mf—10100, pp 32) **Algorithms for counting rate - convenient for digital radiation monitors.** Koturovic, A.M.; Vukanovic, R.B. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14108 (INIS-mf—10100, pp 34) **Model of beta and gamma interaction and Monte Carlo calculations used for the ionization chamber energy dependent response function determination.** Smelcerovic, M.; Markovic, P.; Stojanovic, M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14109 (INIS-mf—10100, pp 36) **Use of microprocessors and microcomputers in liquid scintillation counting.** Schoenhofer, F.; Henrich, E. (Umweltbundesamt, Wien, Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14110 (INIS-SU—392, pp 388) **System for photonuclear reaction product detection with A and Z high resolution.** Batij, V.G.; Vladimirov, Yu.V.; Gamayunov, S.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14111 (INIS-SU—392, pp 392) **Measuring complex for study on the nuclear reaction differential cross sections.** Gafarov, A.A.; Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pak, Eh.A.; Pirogov, V.A.; Ragachurin, R.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14112 (INIS-SU—392, pp 395) **Measurement system for simultaneous comparative study on the (p,pn) and (p,2p) reactions.** Shostak, V.B.; Badovskij, V.P.; Kumshaev, S.B.; Palkin, G.P.; Likhachev, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14113 (INIS-SU—392, pp 396) **Detecting intermediate mass ions and heavy recoils by thin-film breakdown counters.** Gorshkov, I.Yu.; Smirnov, A.N.; Ehjsmont, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14114 (INIS-SU—392, pp 398) **Charged particle spectrometer for study on the (n,p) and (n,np) reactions.** Kovrigin, B.S.; Pel'shau, I.O. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14115 (INIS-SU—392, pp 399) **Heavy ion generator for investigation and calibration of charged particle detectors.** Slyusarenko, A.I.; Aleksandrov, A.A.; Pyatkov, Yu.V.; Shemetov, A.N.; Demidovich, N.N.; Shatunov, V.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14116 (INIS-SU—392, pp 404) **On-line gamma spectrometer with timing channel for in-beam operation.** Saidgareev, V.M.; Filatenkov, A.A.; Chuvaev, S.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14117 (INIS-SU—392, pp 515) **Charged particle selection in semiconduction detectors by time characteristics of analyzed pulses.** Brudanin, V.B.; Sandunovskij, V.G.; Rukhadze, N.I.; Pichits, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14118 (INIS-SU—392, pp 516) **On the effect of a line instrumental form on the antineutrino mass estimation from tritium beta decay.** Pokrovskij, V.N.; Prostakov, I.A.; Vylov, Ts.; Chistyakov, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14119 (INIS-SU—392, pp 518) **Gamma spectrometer on the base of the BaF/sub 2/ scintillator.** Kuznichenko, A.V.; Lebedev, V.N.; Onishchenko, G.M.; Surnin, V.N.; Ter-Nersenyants, V.E.; Sokolov, V.A.; Sinev, A.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14120 (INIS-SU—392, pp 519) **Spectrometric characteristics of high-density scintillators.** Kuznichenko, A.V.; Lebedev, V.N.; Onishchenko, G.M.; Surnin, V.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14121 (INIS-SU—392, pp 520) **Spectrometer for many-dimensional gamma spectroscopy on the base of the SM-1300 microcomputer.** Vishnevskij, I.N.; Gavrilyuk, V.I.; Ofengenden, R.G.; Patlan', Yu.V.; Sidorenko, V.A.; Tkachuk, I.P.; Trishin, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14122 (INIS-SU—392, pp 521) **Analytical description of semiconductor and scintillation detector peak shape.** Kuptsov, G.N.; Nemashkalo, B.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14123 (INIS-SU—392, pp 523) **Model' of compensated zone formation in a semiconductor material during a thick detector fabrication.** Iskanderov, A.Sh.; Muminov, R.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14124 (INIS-SU—392, pp 526) **Magnetic prismatic beta spectrometer with several intermediate images in lenses.** Akhmetov, K.M.; Balashov, V.I.; Bobykin, B.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14125 (INIS-SU—392, pp 527) **Special processor for spectrometry of nuclear microanalysis.** Ovcharov, A.M.; Padusenko, A.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14126 (INIS-SU—392, pp 389) **Coordinate proportional chamber with a delay line for the Apel'sin magnetic spectrograph.** Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14127 (INIS-SU—392, pp 390) **Coordinate proportional chamber with two resistive anodes.** Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14128 (INIS-SU—392, pp 391) **Three-channel particle detection system for a magnetic spectrograph.** Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14129 (INIS-SU—392, pp 393) **Proportional chamber with electronic circuits for particle scanning by reentrant angles.** Gafarov, A.A.; Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14130 (INIS-SU—392, pp 405) **Facility for study on the (γ,pγ') and (γ,πsup(0)γ') reactions on light nuclei.** Naumenko, G.A.; Repenko, E.V.; Stibunov, V.N.; Tomchakov, V.K. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14131 (INIS-SU—392, pp 394) **Amplifier-shaper with threshold digital control for proportional chambers.** Gafarov, A.A.; Kadishnov, A.K.; Koblik, Yu.N.; Mazitov, B.S.; Pirogov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14132 (INIS-SU—392, pp 524) **Position sensitive chamber with distributed delay line for a magnetic spectrometer.** Tokmakov, A.V.; Chumin, V.G.; Vakhtel', V.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14133 (INIS-SU—392, pp 514) **Increase of a pulse analyzer fast response.** Vesna, V.; Ivanov, V.V.; Okunev, I.S.; Smotritskij, L.M.; Shul'gina, E.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14134 (INIS-SU—392, pp 522) **Interaction display system for radionuclide decay scheme determination.** Gorozhankin, V.M.; Kapustina, L.L.; Brudanin, V.B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14135 (INIS-SU—392, pp 529) **Magnetic beta spectrometer with double focusing and a position sensitive detector in the focal plane.** Babenkov, M.I.; Zhdanov, V.S.; Starodubov, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14136 (INIS-SU—392, pp 537) **Performance of the germanium radiation detectors at the liquid helium temperature.** Alpatov, V.G.; Davydov, A.V.; Korotkov, M.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14137 (INIS-SU—392, pp 542) **Spectrometric properties of the CdWO/sub 4/ monocrystals.** Nagornaya, L.L.; Cherkasov, A.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14138 (INIS-SU—392, pp 544) **Alpha and gamma spectrometry on the base of cadmium and zinc tungstates.** Batenchuk, M.M.; Zelenskaya, O.V.; Nagornaya, L.L. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14139 (INIS-SU—392, pp 557) **High-order multiplet resolution in time-of-flight mass spectra.** Slyusarenko, A.I.; Churakov, A.K. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14140 (INIS-SU—392, pp 561) **Lithium-drifted flight semiconductor detectors for telescope systems.** Daudov, Z.Kh.; Lejderman, E.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14141 (INIS-SU—392, pp 565) **Detector background importance in the semiconductor detector spectrometry taking as an example energy-dispersion X-ray fluorescence analysis.** Smol'nyakov, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14142 (INIS-SU—392, pp 530) **Studing the properties of combined x-ray detectors consisting of scintillators and photodetectors.** Basenko, V.K.; Kosharskij, K.G.; Kashutskij, Yu.E.; Sit'ko, S.P.; Skopyuk, M.I.; Shevchenko, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14143 **(LA-UR—86-4183) Performance of the reaction-product transport line associated with the TOFI [Time-of-Flight Isochronous] spectrometer.** Vaziri, K.; Wohn, F.K.; Vieira, D.J.; Wollnik, H.; Wouters, J.M. (Los Alamos National Lab., NM (USA); Utah State Univ., Logan (USA); Ames Lab., IA (USA); Giessen Univ. (Germany, F.R.)). Aug 1986. Contract W-7405-ENG-36. 21p. (CONF-860815—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003732.

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A reaction-product transport line with a solid angle acceptance of 2.8 msr and a momentum-to-charge acceptance of 28% has been constructed to deliver neutron-rich nuclei produced in heavy-target fragmentation reactions to the Time-Of-Flight Isochronous (TOFI) spectrometer. The design and performance of the transport line, which incorporates a mass-to-charge filter to reduce the rate of uninteresting ions entering the spectrometer, is described.

14144 **(LA-UR—86-4184) The Time-of-Flight Isochronous (TOFI) spectrometer for direct mass measurements of exotic light nuclei.** Wouters, J.M.; Vieira, D.J.; Wollnik, H.; Butler, G.W.; Kraus, R.H. Jr.; Vaziri, K. (Los Alamos National Lab., NM (USA); Giessen Univ. (Germany, F.R.); Clark Univ., Worcester, MA (USA); Utah State Univ., Logan (USA)). Aug 1986. Contract W-7405-ENG-36. 19p. (CONF-860815—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003733.

From 11. international conference on electromagnetic isotope separators and techniques related to their applications; Los Alamos, NM, USA (18 Aug 1986).

A new type of time-of-flight recoil spectrometer designed to measure the masses of neutron-rich light nuclei has recently been completed at LAMPF. The spectrometer relies on an isochronous design that directly correlates an ion's time-of-flight through the spectrometer with it's mass-to-charge ratio. Additional measurements of the ion's velocity and energy enable the charge state of the recoil to be uniquely defined and thus permit precision mass measurements given sufficient statistics. The performance of the spectrometer has been investigated in both off-line (using alpha sources) and on-line tests. The design resolution of $\Delta m/M = 1/2000$ (FWHM) has been achieved. Initial performance results of the spectrometer are described with emphasis placed on the techniques used to achieve the overall high mass resolution and large solid angle/momentum acceptance.

14145 **(LBL—21042) Scintillation photon detection and event selection in high resolution positron emission tomography.** Turko, B.T.; Zizka, G.; Lo, C.C.; Leskovar, B.; Cahoon, J.L.; Huesman, R.H.; Derenzo, S.E.; Geyer, A.B.; Budinger, T.F. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 8p. (CONF-861007—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003538.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

The scintillation photon detection and event selection subsystem for the high spatial resolution Donner 600-channel positron emission tomograph is described. The tomograph spatial resolution of better than 3.0 mm, FWHM, is obtained by using 600 closely-packed bismuth germanate 3 mm thick scintillation detectors. Each detector has its own 13.5 mm diameter photomultiplier and event selection channel, consisting of two fast pulse amplifiers, a charge integrator, a differential pulse height discriminator and precision time delay for event strobing. The event selection channel is capable of starting a timing cycle from the first photoelectron emitted from the photocathode. It is also capable of discriminating between true events and noise and of eliminating events occurring simultaneously in two adjacent channels. Adjustments of the event strobing time and two discriminator levels are performed by a computer.

14146 **(LBL—21575) Fast signal calibration systems for large detector system front ends.** Lo, C.C.; Kirsten, F.A.; Nakamura, M. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 8p. (CONF-861007—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003527.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

The fast risetime of the calibration signal in a 10 ns front end of a large detector system presents problems not generally encountered in a slower system. The distribution of these signals also presents its own unique set of problems. We have arrived at solutions which are applicable to large systems requiring fast risetime calibration signals in a small volume of space.

14147 **(N—87-10376) Research relative to high resolution camera on the advanced x-ray astrophysics facility. Final report, 13 May 1985-15 March 1986.** (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Sep 1986. 14p. (NASA-CR—179757; NAS—1.26:179757). NTIS, PC A02/MF A01.

The HRC (High Resolution Camera) is a photon counting instrument to be flown on the Advanced X-Ray Astrophysics Facility (AXAF). It is a large field of view, high angular resolution, detector for the x-ray telescope. The HRC consists of a CsI coated microchannel plate (MCP) acting as a soft x-ray photocathode, followed by a second MCP for high electronic gain. The MCPs are readout by a crossed grid of resistively coupled wires to provide high spatial resolution along with timing and pulse height data. The instrument will be used in two modes, as a direct imaging detector with a limiting sensitivity of 10 to the -15 ergs sq cm sec in a 10 to the 5th second exposure, and as a readout for an objective transmission grating providing spectral resolution of several hundreds to thousands.

14148 **(N—87-10758) Design support of the Burst and Transient Source Experiment (BATSE) of the Gamma Ray Observatory (GRO) mission. Final technical report.** Stephan, E.A. Jr. (California Univ., San Diego (USA)). Sep 1986. 6p. (NASA-CR—178920; NAS—1.26:178920). NTIS, PC A02/MF A01.

Engineering design specifications and development of the large area detector and photomultiplier tube assemblies for the Burst and Transient Source Experiment (BATSE) of the Gamma Ray Observatory (GRO) mission are examined.

14149 **(N—87-11142) Calibration of photographic and spectroscopic films. 1: Film batch variations of reciprocity failure in IIaO film. 2: Thermal and aging effects in relationship to reciprocity failure. 3: Shifting of reciprocity failure points as a function of thermal and aging effects. Semiannual report, December 1986.** Peters, K.A.; Atkinson, P.F.; Hammond, E.C.,JR. (Morgan State Univ., Baltimore, MD (USA)). 1986. 51p. (NASA-CR—179833; NAS—1.26:179833). NTIS, PC A04/MF A01.

Reciprocity failure was examined for IIaO spectroscopic film. Three separate experiments were performed in order to study film batch variations, thermal and aging effects in relationship to reciprocity failure, and shifting of reciprocity failure points as a function of thermal and aging effects. The failure was examined over ranges of time between 5 and 60 seconds. The variation to illuminance was obtained by using thirty neutral density filters. A standard sensitometer device imprinted the wedge pattern on the film as exposure time was subjected to variation. The results indicate that film batch differences, temperature, and aging play an important role in reciprocity failure of IIaO spectroscopic film. A shifting of the failure points was also observed in various batches of film.

14150 **(N—87-11589) Effects of backing plates on the electron exposure of thin polymer films.** Chang, C.K.; Seltzer, S.M.; Wilson, J.W. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1986. 16p. (NASA-TM—88995; L—16183; NAS—1.15:88995). NTIS, PC A02/MF A01.

The effects of backing plates on the radiation dose received by thin nylon films were calculated using recently developed multilayer electron transport codes. The film dose increased with increasing atomic number of the backing plate. The estimated dose could be off by a factor of 2 or more if the backing plate were ignored in the calculations.

14151 **(PB—87-113817/XAB) Workshop manual for computer-interfaced scintillation-camera quality assurance.** (Vanderbilt Univ., Nashville, TN (USA). School of Medicine). Sep 1986. 80p. NTIS, PC A05/MF A01.

The manual is designed for use in the Computer-Interfaced Scintillation Camera Quality Assurance Workshop which aids nuclear medicine personnel in organizing and implementing quality-assurance programs in their facility. Included in the manual are material on the historical development of camera-computer systems; a discussion of nuclear-medicine computer hardware and the process of data collection by the system; and suggestions concerning radioactive sources, phantoms, and preventive maintenance. System performance tests are presented in detail, with a recommended schedule.

14152 **(PNL-SA—14039) Improving health physics measurements by performance testing.** Swinth, K.L.; Roberson, P.L.; MacLellan, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1986. Contract AC06-76RL01830. 27p. (CONF-861044—6). NTIS, PC A03/MF A01. File Number DE87004467.

From Hanford Life Sciences symposium: radiation protection-a look to the future - celebrating four decades of research at Hanford; Richland, WA, USA (21 Oct 1986).

Performance testing standards have been written to establish minimum performance requirements for personnel dosimeters, radiation survey instruments, and bioassay laboratory measurements. These standards were subjected to experimental evaluation and to a consensus review to assure that the requirements were practical. Programs have been established using the personnel dosimeters standards to improve and control the performance of dosimeter processors. Similarly, implementation of performance testing of instruments will result in improved reliability of field measurements and initiation of a program based on the bioassay standard will improve the accuracy, precision, and detectability levels for the measurement of radioactivity in occupationally exposed workers. Evaluating the performance of health physics measurement tools will lead to improved accuracy and precision and to an improved knowledge of personnel exposures. Performance testing will become a more widely recognized tool for maintenance of a quality program and the concept will be applied to additional measurements. 32 refs., 3 tabs.

14153 **(SAND—86-0964) A gondola and pointing system for a gamma ray telescope.** Sayers, A.D.; Dowdican, M.C. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1986. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01. File Number DE87004561.

Details are reported of a gondola for carrying a gamma telescope during balloon flight and protecting it upon landing, and also of the mechanical drives needed to point the telescope with the required accuracy and stability needed to make precise measurements. The gondola is approximately 8′ x 8′ at its base and 16′ tall, made of aluminum tubing and bar, and weighing about 800 lb. The pointing system is an elevation over azimuth arrangement which allows 360 degrees of azimuth and from zenith to 20 degrees above horizontal for elevation. (LEW)

14154 **A reflection grating spectrometer for the X-ray Multi-Mirror (XMM) space observatory: Design and calculated performance.** Hettrick, M.C.; Kahn, S.M. (Lawrence Berkeley Lab., Center for X-Ray Optics B80-101, Berkeley, CA 94720). pp 291-300 of X-ray instrumentation in astronomy. Cuhlane, J.L. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1985). (CONF-851298—). Contract AC03-76SF00098.

From Conference on X-ray instrumentation in astronomy; Cannes, France (2 Dec 1985).

The authors present a spectrometer design candidate for the X-ray Multi-Mirror (XMM) observatory, being planned by the European Space Agency (ESA) as a long-lived large-area array of telescopes. The science requirement of moderate resolution ($E/\Delta E \approx 100$) spectroscopy in a two octave region (0.5-2 KeV) with extremely high throughput (effective area $>$ 500 cm/sup 2/) results in the use of grazing incidence reflection gratings. Due to the low image quality of the telescopes ($\approx$ 1 minute of arc), the grating dispersion must be maximized by use of the classical grating mount in which the spectrum is dispersed within the plane of incident radiation. Due to the small field of view afforded by the x-ray telescopes, the gratings must be situated in the converging beam at the exit of the telescope. A spectrometer module consists of a thin-foil conical mirror telescope, a stack of plane varied-space reflection gratings and an imaging proportional counter. This system is analyzed on the basis of dispersion, geometric aberrations and efficiency.

14155 **Performance characteristics of a planar positron camera with slot collimators.** Bennett, G.W.; Brill, A.B.; Zubal, I.G. (Brookhaven National Lab., Upton, NY). *Journal of Nuclear Medicine;* **25**: No. 5, 102(1984). (CONF-840619—).

From 31. annual meeting of the Society of Nuclear Medicine; Los Angeles, CA, USA (5 Jun 1984).

The UNICON, in positron mode, consists of two large field-of-view scintillation cameras in coincidence, on a rotating gantry. With bare crystals the sensitivity to singles counts and chance coincidences from activity beyond the system field of view causes increased dead time and very low maximum detected coincidence rate. Use of a collimator for each detector with slots orthogonal to the axis of rotation reduces the sensitivity to outlying activity. A clinically realistic distribution of sources and absorbers produced a maximum coincidence rate of 300/sec with bare crystals. This was increased to 4000/sec using collimators with 1 cm-wide slots, 1 cm-thick septa, 7.5 cm deep. A graded filter of lead and copper between collimator and crystal face increased the maximum detected rate to 6000/sec. Detector electronics are relatively standard so that compatability is maintained with UNICON operation in single photon mode. Detector dead times, detected spectra, system sensitivity and resolution, and chance coincidence fractions are presented for bare detectors, collimated detectors, and collimated detectors with graded filters. The slot collimators provide a system geometry similar to ring detector PET units, and allow use of those reconstruction algorithms as well as true 3D algorithms.

14156 **4π detectors.** Abolins, M.; Barnett, B.A.; Binnie, D.M.; Bulos, F.; Carr, J.; Ferbel, T.; Glaubman, M.J.; Holloway, L.; Huston, J.; Kanofsky, A.S.; Lubatti, H.J. (Stanford Univ., CA). pp 623-634 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984). Contract AC03-76SF00515.

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO, USA (23 Jun-13 Jul 1984).

The 4π Detector Working Group tried to address two major questions: can general 4π detectors be built for the SSC that will be able to study rare processes at center-of-mass energies of 40 TeV and at luminosities of 10^{33} cm^{-2} sec^{-1}; what are realistic cost estimates for such detectors? The general conclusions of these studies were that these types of detectors could be built, would be able to do physics under these conditions, and would each cost between 200 and 300 million dollars

14157 **Electron identification.** Yodh, G.B.; Suzuki, Y.; Morrison, R.J.; Abrams, G.; Marriner, J.; Gilchriese, M.; Imlay, R.; Kanofsky, A.; Alverson, G.A.; Cooper, J.W.; Mikamo, S. (Univ. of Maryland, College Park). pp 523-529 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984).

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

A detailed design for a transition radiation detector is presented. Electron calorimetry, synchrotron radiation detection and electron-hadron discrimination are also considered.

14158 **Transition radiation detector for a 4-π detector.** Kanofsky, A.; Marriner, J.; Morrison, R.; Suzuki, Y.; Yodh, G.B. (Lehigh Univ., Bethlehem, PA). pp 639-640 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984).

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

The authors describe here the construction and operating parameters of a transition radiation detector for use in a 4-π detector. At the SSC, it will be important to detect electrons since many of the decays of the existing known and predicted particles are supposed to have substantial electron decay modes. In addition, it is useful if one is interested in particle identification of any kind for flavor identification in jets, etc. In this paper, they discuss the incorporation of a transition radiation detector into a 4-π detector such as discussed by C. Kirby et al. Such a detector may be used for both electron identification and discrimination between Kaons and muons at higher energies (200 GeV - 1000 GeV).

14159 **Multiplicity hodoscope for small angle high rapidity particle multiplicity measurements.** Theodosiou, G.; Fleischman, J.; Kononenko, W.; Selove, W.; Kanofsky, A. (Univ. of Pennsylvania, Philadelphia). pp 641-642 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984).

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

The authors describe the design and performance of a small angle high rapidity beam hodoscope that can be used for multiplicity measurements at the SSC. Such a hodoscope was used in a fixed target p-p experiment, E609, at FNAL.

14160 **Detection of electrons close to jet axes.** Kanofsky, A. (Lehigh Univ., Bethlehem, PA). pp 532-533 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984). Contract AC02-76ER02894.

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

In the decays of the t quark and other anticipated new particles into a quark, electron, and neutrino, there will be difficulty in detecting the electron if the center of the quark jet axis is too close to the electron. If the center of the jet axis is too close to the electron, there will be an overlap of the electron with the hadron shower and thus it will be difficult to distinguish if there is an electron mixed in with the shower. The author has generated Monte Carlo events of t quark (or other heavy particle) three body decays according to phase space, and have then Lorentz transformed the events into the laboratory frame. He has then calculated for each event generated the opening angle between the electron and the quark direction. As well, to take into account the fragmenting of the quark into a jet and the resulting angular spread, he has calculated the jet fragmentation opening angle using the values predicted from various theories, and he has then calculated the difference between this angle and the electron-quark opening angle. In this way, he has obtained an indication of the angular spread between the jet near outer boundary and the electron.

14161 **Electron detection using synchrotron radiation.** Kanofsky, A. (Lehigh Univ., Bethlehem, PA). pp 534-535 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984). Contract AC02-76ER02894.

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

The author presents calculations for the detection of photons from synchrotron radiation, and he discusses how it can be incorporated into existing electron detection schemes. The detection of electrons by synchrotron radiation has been proposed and used by S. Aronson and L. Pondrom, and preliminary calculations on this method have been presented by S. Aronson. In this paper, he considers in more detail the method of using the synchrotron radiation emitted by accelerated electrons in magnetic fields in a practical detector. One scheme would utilize the detection of the photons in a gas of Xe, much in the same way as photons from transition radiation are detected. In fact the energy of the detected gamma rays are very close for the two methods and thus it is expected that they could make use of in fact the identical detectors.

14162 **Channeling applications at the SSC.** Kanofsky, A. (Lehigh Univ., Bethlehem, PA). pp 656-658 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984). Contract AC02-76ER02894.

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

Channeling, the directed motion of a particle along crystal planes and axes by the coulomb repulsion of the atomic cores of the crystal atoms, has been under investigation for many years at low energies and more recently, since 1975, at high energies. Such effects as particle beam bending, synchrotron radiation, reduced energy deposition, and reduced crystal density can be useful for particle detection and directed motion at very high energies. In the following, he discusses the scaling up of the channeling parameters to the very high energies of the SSC, and how such properties can be utilized for in some cases unique experiments.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 13828, 14011

14163 **(AD-A—173097/7/XAB) Effect of operating frequency in the radiation-induced buildup of trapped holes and interface states in MOS devices. Final report, 3 July 1984-15 June 1985.** Stanley, T.D. (Air Force Weapons Lab., Kirtland AFB, NM (USA)). Jul 1986. 110p. (AFWL-TR—86-12). NTIS, PC A06/MF A01.

The amount of threshold-voltage shift in MOS devices caused by ionizing radiation is strongly dependent on the bias voltage applied to the gate of the MOS device both during and after the radiation. Past experimenters found that n-channel MOSFETs alternately biased off and on did not have a threshold-voltage shift that corresponded to the average bias, but the observed shift was more positive than the shift for either the continuously on-or-off bias conditions. In the work presented here, over 200 test transistors, built in a radiation-hardened 4/3 micron process, were irradiated at various operating frequencies, temperatures and bias voltages in an effort to understand the observed threshold voltage shifts were determined through subthreshold current measurements. This research demonstrated the source of this anomalous alternating bias effect on the radiation response of MOS devices is reduced hole trapping and increased interface state buildup in n-channel MOS devices. In p-channel devices, reduced hole trapping is the primary source of this effect. This effect results when holes, trapped at the oxide-silicon interface during the on-half of the cycle, are annihilated by radiation-produced electrons pulled into the trapped hole space charged during the off-bias portion of the cycle.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 13019, 13242, 13311, 13957, 14021, 14022, 14023, 14074, 14269, 15120

14164 **(AD-A—174065/3/XAB) Feasibility assessment of piezoelectric crystals as chemical warfare agent sensors. Final report, 1 August 1983-31 August 1985.** Balog, P.P.; Stanford, T.B.; Nordstrom, R.J.; Burgener, R.C. (Battelle Columbus Labs., OH (USA)). Apr 1986. 84p. NTIS, PC A05/MF A01.

The feasibility of a vibrating piezoelectric crystal as a CW agent detector was assessed by applying CW agent-sensitive coatings to the crystal and testing the detector with 0.3 mg/cum of GB (Sarin). Eight different coating materials were selected, based on previous data with G-agent simulants. No responses were observed to 0.3 mg/cum. GB, but three costings (XAD-4/Cu(2=)-diamine, polyethylenemaleate, and succinyl choline chloride) gave responses of -59 Hz, -22 Hz, and =11 Hz, respectively, to 10 mg/cm.of DIMP (diisopropyl methylphosphonate). Circuit optimization and the use of an operating frequency higher than 9 MHz is recommended to enhance sensitivity. Far-term recommendations are to apply the same coatings to a high-frequency (e.g., 300 MHz) surface acoustic-wave device and test again with CW agents.

14165 **(AD-A—174086/9/XAB) Design of radiographic enhancement systems. Final report.** Hayford, D.T. (Battelle Columbus Labs., OH (USA)). Sep 1986. 66p. NTIS, PC A04/MF A01.

Preliminary specifications and designs are given for two radiographic enhancement systems. The first system is a portable system designed to be carried with EOD teams to enhance the contrast of low-density, low-contrast radiographs made with existing EOD radiographic equipment. The second system contains both image-enhancement and improved radiographic equipment and is designed to be carried aboard commercial or military aircraft in an air-transportable pod. Expected production costs and equipment selection are included.

14166 **(ANL/FE—86-4) Particle velocity and solid volume fraction measurements with a new capacitive flowmeter at the Solid/Gas Flow Test Facility.** Bobis, J.P.; Porges, K.G.A.; Raptis, A.C.; Brewer, W.E.; Bernovich, L.T. (Argonne National Lab., IL (USA)). Aug 1986. Contract W-31-109-ENG-38. 97p. NTIS, PC A05/MF A01. File Number DE87004556.

The performance of a new capacitive flowmeter has been assessed experimentally in a gas-entrained solid flow stream at the Argonne National Laboratory (ANL) Solid/Gas Flow Test Facility (S/GFTF) for solid feedrates in the range of 0.5 to 2 kg/s and solid-gas loadings up to 22, corresponding to a range of solid volume fractions extending from 0.004 to 0.016. Two types of nonintrusive instruments using the capacitive principle were fabricated at ANL and installed in the horizontal leg of a 12.3 m test section to sense the solids. An improved electrode geometry designed to maximize the coverage of the duct interior while minimizing the readout error due to a nonuniform electric field, was incorporated for one spoolpiece with the sensing electrodes on the outside surface of a ceramic liner and for another spoolpiece with the sensing electrodes mounted flush with the duct inside surface. The capacitive instruments measured the solid volume fraction and the average particle velocity. The results are compared with time-of-flight measurements of short-lived radioactive particles that duplicate closely the size and density of the 1000μ glass beads used in these flow tests. Results show that the solid volume fraction measurements agree with the theoretical models presented and that the particle velocity deduced from the cross-correlation scheme agreed to within 5% of the irradiated particle velocity technique for the 21 to 31 m/s range generated with the S/GFTF. 43 refs., 36 figs., 19 tabs.

14167 **(CONF-8607106—1) Extending the capabilities of the portable chemical parameter spectrometer to identification of up to 100 compounds.** Zaromb, S.; Battin, R.; Penrose, W.R.; Stetter, J.R.; Stamoudis, V.C.; Stull, J.O. (Argonne National Lab., IL (USA); Coast Guard, Washington, DC (USA). Office of Research and Development). 1986. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87001495.

From 2. international meeting on chemical sensors; Bordeaux, France (7 Jul 1986).

An algorithm has been developed that will extend the capability of the Chemical Parameter Spectrometer (CPS) to identification of any one of up to 100 compounds. The algorithm divides a given set of compounds into smaller subsets according to empirical criteria such as initial sensor responses, generation of an electro-reducing signal, and rates of decay of sensor signals after discontinuance of a tested compound. These features are used to first assign an unknown compound to an appropriate subset and thereafter to identify it using a pattern-matching algorithm. This branching greatly reduces the computation time and the probability of misidentifications.

14168 **(DOE/ER/40257—002) On the Drexel long path spectrophotometer: Status report.** Ide, N.; Steinberg, R.I. (Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science). 3 Jan 1987. Contract AC02-86ER40257. 6p. NTIS, PC A02/MF A01. File Number DE87004419.

A new horizontal version of the long path spectrophotometer is described and a preliminary measurement is reported. The attenuation length of unfiltered WITCO LP100 mineral oil is found to be 904 +- 34cm at a wavelength of 470 nm.

14169 (INIS-SU—392, pp 550) **Sensitivity of Moessbauer spectroscopy with electron radiation detection.** Ali-Zade, I.I.; Babikova, Yu.F.; Vakar, O.M.; Petrikin, Yu.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14170 (INIS-SU—392, pp 582) **Studying the performances of a wide-band analog-to-digital converter.** Basenko, V.K.; Kosharskij, K.G.; Kasutskij, Yu.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14171 **(LA-UR—86-4210) Soft x-ray spectral measurements for temperature determination of laser produced aluminum plasmas.** Mitchell, K.B.; Abdallah, J. Jr.; Peek, J.M. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 8p. (CONF-861177—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003739.

From 9. international conference on lasers and applications; Orlando, FL, USA (3 Nov 1986).

Time and space resolved measurements were made on plasmas produced by the SPRITE laser focused on aluminum targets. The experimental spectra are compared to theory in order to determine a characteristic plasma temperature. 4 refs., 8 figs.

14172 **(PB—87-140315/XAB) Technical activities 1986, Center for Basic Standards.** Heydemann, P.L.M. (National Bureau of Standards, Washington, DC (USA). Center for Basic Standards). Oct 1986. 340p. (NBSIR—86/3469). NTIS, PC A15/MF A01.

The report summarizes the research and technical activities of the Center for Basic Standards during the Fiscal Year 1986. These activities include work in the areas of electricity, temperature and pressure, mass and length, time and frequency, quantum metrology, and quantum physics.

14173 **(SAND—86-0440C) Laser spectroscopy and gas-phase chemistry in CVD.** Ho, P.; Breiland, W.G.; Coltrin, M.E. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 2p. (CONF-870304—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007392.

From 2. ASME/JSME thermal engineering conference; Honolulu, HI, USA (22 Mar 1987).

The experimental work involves the use of laser spectroscopic techniques for in situ measurements on the gas phase in a chemical vapor deposition reactor. The theoretical part of the program consists of a computer model of the coupled fluid mechanics and gas-phase chemical kinetics of silane decomposition and subsequent reactions of intermediate species. The laser measurements provide extensive data for thoroughly testing the predictive capabilities of the model.

14174 **(SAND—86-1759) Comparison of two pyrometers used to calibrate Primary Standards Laboratory's tungsten filament lamps.** Odom, M.K. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87005216.

The Primary Standards Laboratory presently uses an automatic optical pyrometer with a photomultiplier tube photodetector to calibrate tungsten filament lamps. This pyrometer is compared to a newly designed direct optical pyrometer with a photodiode photodetector. Though the direct pyrometer looks promising, final improvements are necessary to make a conclusive comparison.

14175 **(TRI-PP—86-99) Fiber scintillators coupled to a multianode photomultiplier as a high rate tracking detector.** Salomon, M.; Coombes, H.; Nissen, M.; Rogers, J.G. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 3p. (CONF-861007—20). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900325.

From Nuclear science and nuclear power systems symposium; Washington, DC, USA (29 Oct 1986).

We have studied the properties of a photomultiplier with two sets of orthogonal anode wires. We measured the gain and the position response of this device using a point light source, extended scintillators and fibre scintillators in several geometries. Tests were done with sources and in a pion beam. In addition we studied the high rate capabilities of the device.

14176 **(Y—2375) Automatic, transparent, thin-film-thickness inspection system for complex shapes.** Corey, H.S.; Travis, H.G. (Oak Ridge Y-12 Plant, TN (USA)). Dec 1986. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004571.

An automatic, transparent, thin-film-thickness inspection system for complex shapes is discussed. The basic elements of the system are a light section microscope (LSM) used to produce an optical signal proportional to the film thickness and a multiple-axes robot used to automatically position the LSM at the desired inspection points. The system measures film thickness from 0.013 to 0.250 mm (0.0005 to 0.010 in.) and as a repeatability of +-0.003 mm (+-0.0001 in.). The major development efforts consisted of (1) designing a vision system for the LSM, (2) providing for automatic readout of the film-thickness data, and (3) final positioning of the LSM using the viewed optical patterns. Also, a simple standard was designed and fabricated that provides for traceability to the National Bureau of Standards (NBS) using a coordinate measuring machine. The completed inspection system has been installed in a production shop.

14177 **Double-ended tuning fork quartz accelerometer.** Kass, W.J.; Snow, G.S. (Sandia National Labs., Albuquerque, NM 87115). pp 230 of Proceedings of the 40th annual frequency symposium. Piscataway, NJ; IEEE Service Center (1986). (CONF-8605156—). Contract AC04-76DP00789.

From 40. annual symposium on frequency control; Philadelphia, PA, USA (28 May 1986).

Quartz accelerometers with frequency output have been designed and built using etched double-ended tuning fork technology. These devices consist of two tuning forks connected in a cantilever beam configuration with beryllium-copper spacers which serve as a proof mass and inboard spacer. The frequency outputs of each tuning fork resonant circuit are mixed to yield an output frequency of approximately 1kHz at zero acceleration. The sensitivity of the devices is approximately 1Hz/G. The fundamental vibration frequency of the cantilever beam is 2200Hz in this undamped device. Shock testing up to 1500G has indicated good survivability characteristics. Individual fork measurements compared with assembled cantilevers tested in a +-1G field in the temperature range of -55C to +85C indicate that residual stresses associated with assembly contribute to the temperature sensitivity of the bias frequency. Centrifuge testing has been conducted over the range of 0-120G with an indicated non-linearity of less than 2mG.

14178 **Surface acoustic wave gas sensor based on film conductivity changes.** Ricco, A.J.; Martin, S.J.; Zipperian, T.E. (Sandia National Labs., Albuquerque, NM, USA). *Sensors and Actuators;* 8: No. 4, 319-333(Dec 1985).

The first surface acoustic wave (SAW) sensor that functions via changes in conductivity of a thin surface film is reported. A lead phthalocyanine (PbPc) thin film is deposited on the acoustic propagation path of a LiNbO/sub 3/ SAW delay line, which serves as the feedback element of an oscillator circuit. Reaction with strongly oxidizing gases, in particular NO/sub 2/, increases the conductivity of the PbPc film. Acousto-electric coupling of the traveling electric potential wave associated with the SAW to charge carriers in the PbPc film slows the acoustic wave velocity, altering the oscillation frequency of the circuit. This sensor is about 1000 times more sensitive, in terms of the number of NO/sub 2/ molecules that can be detected (10/sup 16/ molecules/cm/sup 3/ of PbPc film), than an identical SAW sensor functioning via mass loading would be. Sensitivity to a few ppm of NO/sub 2/ in N/sub 2/ has been demonstrated.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 14181

14179 **(AD-A—173680/0/XAB) Direct course near-field seismic motion study. Report for 15 October-31 December 1983.** Battis, J.C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 13 Apr 1984. 17p. (AFGL-TR—85-0318). NTIS, PC A02/MF A01.

AFGL's Solid Earth Geophysics Branch has been developing numerical-modeling techniques for the simulation of seismic-wave propagation in 3-D complex geologic structures. The goal has been the prediction of ground motions due to earthquakes and explosions at distance ranges of 5 to 100 km from the seismic source. The DIRECT COURSE Near Field Seismic Motion Study was intended to provide empirical data against which the numerical procedures could be tested and verified. Five digital 3-component seismic recording units were installed along a radius from the shot point trending approximately SSE at distances of 9 to 50 km from ground zero. Unfortunately, this was the first field installation of the recording system. At the time of the shot, four of the five sites had either electronic or mechanical failures which precluded the recording of DIRECT COURSE ground motions. While one site did record the shot, a single site recording is insufficient for the analysis that was intended. The one available record does, however, demonstrate the importance of developing the 3-D technology for seismic-wave-propagation modeling in areas having complex geologic structure. Numerous late-arriving phases were recorded having amplitudes comparable to or exceeding the primary arrivals in amplitude. The horizontal polarization of these arrivals suggests the importance of lateral structure variation, which is usually ignored, in making accurate motion predictions.

14180 **(SAND—86-2617) Feasibility study of a semiconductor bridge (SCB) for initiating pyrotechnics and explosives.** Bickes, R.W. Jr.; Schwarz, A.C. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004444.

Small metal bridgewires are traditionally used to initiate igniters, squibs, and actuators. This report describes a new initiation mode, a semiconductor bridge (SCB), which is 1/100 the volume of a wire bridge. Our studies indicate that order of magnitude reductions in threshold energy and function time are achievable with no loss in safety (base on "no-fire" data obtained). With appropriate designs, SCB's will function from a 10-volt power source; therefore, marriage to microelectronic switches, logic circuits and firing sets appears practical. Threshold initiation energies of 1.5 to 3.0 mJ, function times of 40 to 70 microseconds, and no-fire levels of 7.5 watts were achieved on devices loaded with the pyrotechnic, TiH/sub .65//$KClO_4$. The high explosives PETN, HNAB, and HMX deflagrated at comparable low energy levels.

4502 Nuclear

REFER ALSO TO CITATION(S) 13427, 14293, 14477

14181 **(AD-A—173182/7/XAB) Properties of compacted backfill split-Hopkinson pressure bar. Final report, 1 November 1982-28 February 1985.** Olsen, J.M.; Felice, C.W. (Utah Univ., Salt Lake City (USA). Dept. of Civil Engineering). Dec 1985. 267p. NTIS, PC A12/MF A01.

Loading on buried structures subjected to nuclear or conventional high explosive weapons is strongly influenced by the backfill adjacent to and overlying the structure. The relative stiffness of the structure and the surrounding soil and their interactions will determine the level and extent of damage due to blast loads. White soil response may be in the laboratory, this environment must be able to reflect the type of confinements, magnitude of stress change, and the time scale of loading expected in the problem. The split-Hopkinson pressure bar (SHPB) technique has been adapted to measure the dynamic response of soil to implulse loads. This technique can significantly extend the range of stresses and strain rates that can be applied beyond the capabilities of conventional laboratory dynamic soil-testing equipment. Various assumptions and considerations involve in designing an SHPB experiment and evaluating the data with soil as a specimen are discussed in detail. Soils have low wave speeds, nonlinear hysteretic behavior, and low unconfined compressive strength which complicate SHPB testing. Insight is provided as to how these factors affect experimental accuracy and data reliability. The dynamic soil stress-strain response was found to be governed principally by the initial gas porosity of the specimen. Examples of stress-strain curves are present for specimens with applied stresses ans strain rates up to 520 MPa and 4000/s respectively.

14182 **(LA/Sub—D6927-1) Technical report on containment-related services provided to Los Alamos National Laboratory, July-October 1986.** (Ktech Corp., Albuquerque, NM (USA)). 20 Jan 1987. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004301.

During the months of July through October 1986, Ktech provided technical services to Los Alamos National Laboratory related to the containment of underground nuclear tests. This report provides an unclassified summary of that work. Three separate topics are included: preparation for centrifuge experiments to investigate cavity formation and collapse produced by spherically symmetric explosions, chemical issues related to containment, and phenomenology anticipated for an underground nuclear event.

14183 **(SAND—86-1702) Free-field and decoupling analysis of MILL YARD data.** Garbin, H.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1986. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004455.

Accelerometers were used to measure ground motion of the MILL YARD and DIAMOND BEECH events. MILL YARD was a small-yield event detonated in a hemispherical cavity. Its close-in, free-field data showed the presence of not only the primary explosive signal, but also motion emanating from a source located near the edge of the dome and the cavity floor. Data from accelerometers placed at the surface were used to find the decoupling factor as a function of frequency. At these ranges ($\approx$50 m), there was a signal for frequencies $>$100 Hz. Comparison of the MILL YARD and DIAMOND BEECH high frequencies showed that their amplitudes were about the same, even though the yield of DIAMOND BEECH was two orders of magnitude larger than that of the MILL YARD. DIAMOND BEECH data were scaled to the yield of the MILL YARD, and a decoupling factor of 60 to 70 was found at low frequencies and 8 to 10 at high frequencies. 15 refs., 20 figs., 6 tabs.

14184 **(UCID—20956) Nuclear Test Containment Program, Research and Technology Development Project Stress wave modeling: Annual report.** Thigpen, L. (ed.). (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004453.

This report highlights activities carried out in fiscal year 1986 to develop reliable numerical models for stress wave response in the test environment. Its purpose is to introduce current research areas and to report on recent progress. Current research activities under the Containment Program's stress wave modeling project include code development, computer modeling, material property measurements, small scale physical modeling, and theoretical model formulations. Although current effort features a strong emphasis on the improvement of existing calculational capabilities, the overall project in stress wave modeling is designed to delineate relevant physics and to build reliable numerical models which contain all features necessary to address containment failure.

14185 **(PB—87-103602/XAB) Fields, currents and aerosols in the lower troposphere.** Reiter, R. (National Science Foundation, Washington, DC (USA). Div. of Atmospheric Sciences). 1985. Translation of mono. Felder, Stroeme und Aerosole in der Unteren Troposphaere, Darmstadt, Vol. 71, 1-714(1976). (TT—76-52030). 734p. NTIS, PC A99/MF E04.

Contents include: The network of stations, their geographical location and equipment; Relationship between the atmospheric electric elements and meteorological conditions and phenomena in the layer between 500 and 3000 m amsl; Solar-terrestrial relationships; Atmospheric radioactivity and ionization of air; Results of the study of atmospheric radioactivity and its effects on the earth's surface; Results of quantitative chemico-radiological analyses of samples, 1958-1961; Change in contamination of atmosphere, precipitation, and grass due to nuclear fission products following nuclear weapons tests, autumn, 1961; Review and prospects.

4503 Explosion Detection

14186 (CONF-8604196—Summs., pp 6-32) **First 1.5 years with the Norwegian Regional Seismic Array October 1984-March 1986.** Breding, D.R. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

This presentation details Sandia National Laboratories' operational experience with the Norwegian Regional Seismic Array (NRSA) over its first 1.5 years. It outlines the events that are important to those that use the NRSA data. These events include when and where data was recorded and array changes that affect user. In addition, statistics on data outages and data availability are presented. 16 figures, 7 tables.

14187 (CONF-8604196—Summs., pp 33-58) **Real-time event detection using the NORESS array.** Ringdal, F. (NTNF/NORSAR, Kjeller, Norway). Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

This paper presents initial results from real-time detection processing of data from the small-aperture NORESS array in

Norway. While NORESS was designed primarily to detect and locate seismic events at regional distances, the array detection capability also proved excellent in the teleseismic range. Comparison over a 6-month period to the bulletin from the large NORSAR array showed that NORESS detected 85% of the NORSAR -reported teleseismic events, in addition to many high-frequency teleseismic phases not reported by NORSAR. NORESS estimates of phase velocities and azimuths are, however, not as accurate as those provided by NORSAR. The NORESS 90% incremental detection threshold at teleseismic distances varies from, at best, m/sub b/ 3.00-3.5 in parts of Eurasia to, at worst, m/sub b/ 4.5-5.0 parts of North and Central America. An assessment of NORESS regional detection capability was obtained by comparing to bulletins produced on the basis of local seismic networks in Fennoscandia. NORESS experience has shown that the best SNR for P detection is usually obtained using narrow-band filters within the 1-5 Hz frequency range (teleseismic events) and 3-10 Hz (regional events). 18 figures, 1 table.

14188 (CONF-8604196—Summs., pp 59-76) **Propagation characteristics of regional phases and NORESS real-time processing performance.** Mykkeltveit, S.; Kvaerna, T. (NTNF/NORSAR, Kjeller, Norway). Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Previous investigations have shown that prominent geological features exist within regional distance from NORESS that strongly influence the characteristics of secondary seismic phases. This paper presents results from a comprehensive mapping study utilizing a data base of events with regional propagation paths to NORSAR. The results from this study are presented in the form of detailed color-coded maps that describe the relative propagation efficiency of the two major secondary phases S/sub n/ and L/sub g/, as a function of source region and signal frequency. These maps show that L/sub g/ wave propagation is very efficient for propagation paths that are confined to continental shield type structures, whereas no L/sub g/ is observed, or S/sub n/ dominates over L/sub g/ for propagation paths that cross significant tectonic features like graben structures and continental margins. The correlation between propagation characteristics and the tectonic features is more pronounced the higher the signal frequency. Motivation for the study was to obtain calibration data for the real time processing or regional events recorded on NORESS. For an evaluation of the performance of the NORESS real-time processing, results for 132 events located in Western Norway and the North Sea are presented. 3 references, 13 figures.

14189 (CONF-8604196—Summs., pp 77-102) **NRSA event detection using FPS-5205 Array Processor.** Hickman, B.K. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Software for detecting seismic events in data obtained from the 25-component Norwegian Regional Seismic Array (NRSA) is currently being processed. Such a system would be necessary in analyzing signals from arrays deployed in USSR for seismic verification of test treaties. This system consists of a PRIME host computer and an FPS-5205 Array Processor. Because of the array processor architecture, the data are sectioned into 100 second blocks to be analyzed. Since the data are not processed continuously, only one detection per 100 second block may be found. This means subsequent processing for phase identification and association is needed. Currently, there exists the ability to archive ten hour time intervals of the NRSA signals received via satellite. The event detection process consists of four stages: (1) deglitcher (2) beam former (3) filter and (4) STA/LTA detector. As a first surface, 24 regional beams are formed with bearing evenly spaced every thirty degrees for the P and Lg waves with phase velocities of 8.0 and 4.5 km/sec respectively. The array geometry used when forming regional beams consists of the center, B and C rings. Five teleseismic beams are directed at Semipalatinsk, Novaya Zemlya, Lop Nor, Astrakhan, and the Nevada Test Site, with phase velocities set equal to the surface velocities of the particular source-to-station P-wave teleseismic ray paths. A teleseismic beam with infinite velocity (no signal delays among the components) is also formed. This beam gives simple signal stacking with isotropic azimuthal coverage. 10 figures, 1 table.

14190 (CONF-8604196—Summs., pp 103-114) **Wideband three-component array processing.** Harris, D.; Dowla, F. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

For linearly polarized P-waves, at least, it is possible to deploy sparse arrays that are spatially sub-sampled, so long as the array contains a significant number of three-component stations. Sub-sampling is possible because three-component station are not subject to spatial sampling theorem restrictions, and effectively resolve the aliasing ambiguities that occur with sparse arrays of vertical stations.

14191 (CONF-8604196—Summs., pp 115-133) **Wind effects on the NRSA High-Frequency Seismic Element (HFSE).** Kromer, R.P. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

A High-Frequency Seismic Element (HFSE) was installed as part of the NRSA seismic array near Hamar, Norway. The HFSE utilizes a Teledyne-Geotech 3-axis S3 borehole seismometer based on the Geotech GS13 vault instrument. Seismic data are digitized at 125 samples/second by a set of Gould 24-bit linear high resolution digitizers (EDME). During installation of the HFSE, there was an opportunity to acquire a series of data sets during a storm growing across one NRSA site over a weekend. The HFSE was configured with the S3 vertical axis borehole seismometer on the one channel and the GS13 vertical axis surface vault seismometer on another channel. This allowed for a direct comparison of wind induced noise between the surface and 60 meters deep. Analysis of the NRSA and HFSE background indicate that, for the NRSA passband (0.1 20 Hz), the worst case wind effect increased the seismic background from 3 to 5 db. There appeared to be little or no difference between borehole and surface installation. 17 figures.

14192 (CONF-8604196—Summs., pp 134-159) **Integrated approach to slowness analysis with arrays and three-component stations.** Kvaerna, T.; Doornbos, D.D. (NTNF/NORSAR, Kjeller, Norway). Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

In the past, an online array detection, location, and phase association procedure termed RONAPP was developed and has been in routine use to analyze regional data from the NORESS array. More than one year of experience with this algorithm has shown that in some cases, the azimuth estimates for P and secondary phases from the same event may differ by more than 30° and, therefore, are not correctly associated. At the same time, it is recognized that the methods in routine use do not fully exploit the redundancy in the data. Therefore, a program was begun to extend standard frequency-wavenumber analysis by incorporating a priori information applicable to three-component and possible data can be incorporated into a single filter operation. The matched filter is considered an extension of standard frequency wavenumber analysis, and the maximum likelihood filter as an extension of high-resolution analysis. To use the polarization state in slowness analysis it is necessary to incorporate the surface interaction, and to use wide band data in beamforming; it is an advantage to introduce frequency-consistent phase delays. An application of these methods to a number of events from a site in western Russia shows very stable results. 1 references, 12 figures.

14193 (CONF-8604196—Summs., pp 160-168) **Expert system for interpreting NORSAR events.** Johnson, R.R. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

The number of seismic events seen by NORSAR exceeds 20,000 events per year. Therefore, reliable verification of a CTBT will require an automated system for interpreting and classifying

events. Such an automated system is being developed and prototype is operational. It employs rule-based expert system techniques to provide the expertise acquired by a seismologist through experience. In particular, it uses an assumption based truth maintenance system to support the hypothesis and test methodology used by seismologists. The system is best described as a seismologists's assistant that is capable of both independent operation and a high degree of interaction. It can describe, justify, and modify its decision at the direction of the seismologist. The design philosophy and use of the system is described.

14194 (CONF-8604196—Summs., pp 170-186) **Master event strategy for location with array data.** Harris, D. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Most signal processing methods currently in use with array data assume a simple plane wave model for wave propagation, and suffer often severe reductions in performance when the spatial characteristics of seismic signals depart significantly from that model. In particular, lateral inhomogeneities can cause significant lateral refractions and multipath leading to inaccurate back-azimuth estimates. Presented here is: (1) an application of a broadband frequency-wavenumber spectral estimator that provides a synoptic view of frequency-dependent refraction and multipath. This approach is used to examine the Leningrad propagation anomaly as seen at NORESS. (2) A master event strategy that attempts to compensate the effects of refraction and multipath. The principal application of the master even strategy is to event location, with the basic intention being to determine whether an unknown event comes from the same location as a master event. In the event that there are several possible source regions, the appropriate strategy is to use master events from each to determine the most likely location of the unknown event. 8 figures.

14195 (CONF-8604196—Summs., pp 187-208) **Performance of arrays and three component stations.** Dowla, F.; Harris, D. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

In order to understand the bearing estimation performance of regional signals like that of the NRSA, computer simulations were conducted to determine the direction estimation errors of arrays and three-component stations as a function of signal-to-noise ratio. By employing a broadband wavenumber method in the case of the array and an eigen structure back-azimuth algorithm for the three component station, hundreds of Monte Carlo trials were conducted to determine the error standard deviations at various signal-to-noise ratios. The important fact demonstrated by the simulation is that both array signals and three component direction estimations exhibit a threshold phenomenon: performance deteriorates rapidly below some fairly sharply-defined signal-to-noise ratio. Since arrays have greater redundancy, they exhibit lower signal-to-noise ratios than three-component stations. The authors suggest conclusions of relevance to CTB monitoring: (1) There is a region at very low SNR where arrays have significantly lower bearing error. This suggests that location estimates are better made with arrays than with three component stations from decoupled explosions. (2) The results from studies comparing bearing estimation performance of arrays and three-component stations using events with SNR > 1 are wholly controlled by propagations anomalies such as refraction and scattering.

14196 (CONF-8604196—Summs., pp 209-228) **Some experiments with phase detection.** Goldstein, U. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

The traditional method of detecting seismic phases involves computing the ratio of a short-time average to a long-time average (Sta-lta) energy of the vertical component as a function of time (the sta-lta signal), then determining when this new waveform exceeds a certain threshold. This paper presents two variations on the sta-lta method that rely on three-component data. The variations were tested on 15 mining events from the Leningrad area recorded at NTSA. Performance was judged by counting the number of detections missed for a fixed number of false alarms. The first variation involved computing an sta-lta signal for each component separately, multiplying the three sta-lta signals together, then determining where this product signal exceeded the detection threshold. The number of correct detections was counted for threshold settings just bove the levels of the first 6 false alarms. This variation dramatically improved detection of S/sub n/ and slightly improved detection of L/sub g/ compared to the detections of the vertical-only reference detector. P/sub n/ detection was unaffected. The second variation involved running 3-component data through a Samson-Olson polarization filter, then performing detection with the sta-lta signal of the vertical component. This variation slightly improved detection of P/sub n/, but degraded detection of S/sub n/ and L/sub g/ because of the numerous extraneous peaks that is introduced.

14197 (CONF-8604196—Summs., pp 229-244) **Comparison of the detection performance on one and three component arrays on the P/sub n/ arrays.** Claassen, J.P. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

To resolve whether one should deploy three component or single component arrays, the P/sub n/ detection performance of an M element, a three-component array is compared with the performance of a 3M element, vertical component array. The comparison is based on arrays having the same number of receiver channels, however, the three component array employs polarization matched beamforming as opposed to beamforming alone. An examination of the noise field suggests that more complicated polarization processing is not warranted since the noise is but weakly polarized. The array gain for each configuration served as the basis of comparison. The measured three component character of the noise field is employed to theoretically estimate the array gain for both array configurations. The theoretical estimates are then affirmed with measured results. It is shown that at an incident angle of 30° the vertical component array performs approximately 3 dB better than the three component array. The small advantage associated with vertical component arrays, however, disappears at incident angles near 50°. when assessing the measured performances one must carefully account for the effects of spatial signal decorrelation.

14198 (CONF-8604196—Summs., pp 245-258) **Beamforming considerations at NRSA.** Stearns, S.D. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Some beamforming properties of NRSA are reviewed. A correlation beam, based on cross-correlation peaks, is seen to differ slightly from the beam based on geometry, indicating anomalies in the geology of NRSA. Using SNR data from USSR events, the beamformer outputs are compared with each other and also with other signals, including the output from an omnidirectional beamformer. Some conclusions are presented on the use of beamformers for detection. 11 figures, 1 table.

14199 (CONF-8604196—Summs., pp 260-278) **Teleseismic event analysis for NRSA receiver structure.** Walck, M.C. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Detailed knowledge of local velocity perturbations beneath the Norwegian Regional Seismic Array will enable enhanced detection and location capability of regional seismic events. NRSA's receiver structure was investigated using arrival times of teleseismic events in several frequency passbands. Event waveforms are filtered and cross-correlated with the central element, providing relative arrival times across the array; and L1 plane fit to the time then reveals the angle of incidence and azimuth of approach of the teleseismnic signal. Deviations of these parameters from values derived from global locations indicate wavefront distortion, probably caused by local velocity variations, the distortion can change as a function of frequency. Results from a preliminary data set of seven presumed explosions in the Soviet Union and China indicate significant, frequency-varying effects for events with back-azimuths near

75°, these anomalies are probably due to variations in the near-receiver velocity structure. Analysis of additional data may allow elucidation of frequency-dependent receiver structure, and real the best frequency ranges for event locations. 16 figures.

14200 (CONF-8604196—Summs., pp 279-294) **Applications of a pre-whitening algorithm.** Stearns, S.D. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

The presentation includes the description of a widely applicable pre-whitening algorithm for reducing the bias effects of averaged-periodogram spectral estimates when sharp peaks are present in the actual power spectrum. Examples of the application of this method illustrate its usefulness as well as point out a pitfall that can be easily avoided. 4 references, 10 figures.

14201 (CONF-8604196—Summs., pp 299-308) **Experience with tape archiving at SCARS.** Harrer, S.J. (EG and G Kirtland Operations, Albuquerque, NM). Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

The paper describes the conditions under which tapes are stored at SCARS and whether these were contributing factors to the loss and/or the difficulty of reading data from the tapes. Several studies were done to substantiate what can and did cause the problems with the tapes at SCARS. Measures that can help prevent data loss from the tapes are summarized briefly. 2 figures, 2 tables.

14202 (CONF-8604196—Summs., pp 309-327) **RSTN/NRSA spectral shaping filter responses.** Patton, G. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

In the past, there has been some concern about the response of the spectral shaping filters in both the RSTN and NRSA systems. The area in question involves saturation within the filters without being detected by the clip-detect circuits. Calculations were made to determine points of maximum signal level for each filter. Where this occurred within the filter, correction factors were calculated to help in determining the probability of saturation for a large event. The results of this work showed that the main problem is with the RSTN short-period filter. 14 figures.

14203 (CONF-8604196—Summs., pp 328-370) **Overview of the NORESS High Frequency Seismic Element (HFSE).** Kromer, R.P. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

The HFSE utilizes a Teledyne-Geotech 3-axis S3 borehole seismometer based on the Geotech GS13 vault instrument. Seismic data are digitized at 125 samples/second by a set of Gould 24-bit linear high resolution digitizers (EDME). The HFSE is an experimental system in that this is the first application of the Seismometer and the high resolution digitizer. The S3 seismometer is also the center element in the NORESS array. This allows for comparison between the two elements in the common passband (1-20 Hz). Corrected responses for each element indicate a reasonable correlation between spectra in this passband. A series of tests were performed in the high resolution digitizers. Results indicate a better than 120 db dynamic range with a linearity of 115 db. Output to the data recorder at NORSAR is a via a IBM SDLC data link. During installation of the HFSE, data sets were taken to compare installation techniques of the borehole seismometer, installed at 60 meters, with an existing set of surface-vault mounted GS13s. Results indicate that in the vertical axis, even though background noise is reduced in the borehole, a decreased sensitivity or coupling causes the signal to noise ratio (SNR) to remain the same as the surface vault. Horizontal axes show a slightly lower SNR in the borehole. 31 figures, 2 tables.

14204 (CONF-8604196—Summs., pp 371-387) **Seismic propagation and noise at high frequencies near RSON.** Smith, A.T. Aug 1986. NTIS, PC A23/MF A01. File Number DE86015486.

From RSTN/NORESS research symposium; Las Vegas, NV, USA (30 Apr 1986).

Low-noise sites and efficient propagation across continental paths are essential prerequisites for high frequency (>30 +/- 15 Hz) detection and discrimination of explosions at regional distances. As part of the effort to determine the capability of in-country seismic stations for monitoring nuclear test ban treaties, LLNL conducted a seismic deployment near RSON, Red Lake, Canada, during July and August, 1985. High frequencies were recorded as accelerations sampled at 500 Hz using an S-750 seismometer located within a quarry 6 kilometers from RSON. The seismic instruments recorded seismic noise, local and regional explosions, and various earthquakes at teleseismic distances. From 10 hz to 100 Hz, the seismic noise decays as omega/sup -2.5/ in displacement amplitude during quiet conditions. The portable site was often quieter than RSON, which raises questions of possible seismic noise sources associated with the RSTN stations. For rippled-fired explosions at distances of 400 km, the maximum signal-to-noise occurred at frequencies as high as 26 Hz. Local explosions at distances of a few tens of kilometers have their maximum signal-to-noise between 50 and 70 Hz. 12 figures.

14205 **(USGS—474-321) Shear-wave velocity measurements in volcanic tuff in Rainier Mesa tunnels, Nevada Test Site, Nevada.** Carroll, R.D. (Geological Survey, Denver, CO (USA)). Dec 1986. Contract AI08-76DP00474. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004313.

The identification of shear-wave arrivals on records obtained in the course of seismic surveys in Rainier Mesa tunnels is not generally confirmed using the standard technique of polarization of the waveform by manipulation of the source. Identification of the shear wave is based on recognition of a dominant mode on the record arriving in the shear-wave time window. This requires that additional evidence be examined to rule out the possibility that these are surface waves traveling along the tunnel bore. Given the frequencies of the observed waveform and the properties of the volcanic tuff in which the tunnels are driven, Biot's theoretical treatment of waves in a cylindrical bore supports the conclusion that this event travels at shear-wave velocity. This is further confirmed by empirical evidence indicating this event is dominant when propagated through blocks of tuff between the source and the geophone line as well as when the source is colinear with the geophone line in the tunnel, a circumstance which appears to preclude the generation of predominantly surface waves. The shear wave is most cleanly generated and recognized using a source consisting of detonating cord on a plate or a weight drop, however, the shear wave is frequently dominant on records obtained with borehole charges.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 13905, 13964, 14302

14206 **(CSIR-RR—624) Analysis of $^{15}N/^{14}N$ ratios in natural samples, with emphasis on nitrate and ammonium in precipitation.** Heaton, T.H.E.; Collett, G.M. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.). 1985. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780498.

The nitrogen cycle is one of the most important of the earth's elemental cycles. The report describes the procedures used for the analysis of $^{15}N/^{14}N$ ratios in ammonium and nitrate (and organic nitrogen), and summarizes without discussion the data obtained for precipitation (by rain and dust) collected at the Council for Scientific and Industrial Research site. The $^{15}N/^{14}N$ ratios of nitrogen compounds were determined on N2 gas. This was measured by means of a mass spectrometer. The isotopic analysis of organic nitrogen was conducted in two ways: Kjeldahl digestion to form ammonium, and Dumas combustion directly to N2.

14207 **(DFVLR-FB—86-42) Radar measurement methods for the observation of convective clouds and comparison of measurements and numerical simulation.** Schuster, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1986. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751174.

This paper describes radar measurement methods for the investigation of radar reflectivity, precipitation rate and liquid water content in isolated, convective clouds. The used computer-controlled radar system permits the representation of the above mentioned parameters in form of 3-dimensional, time-dependent variables. The limiting conditions during the observation of objects being variable in time and space will be discussed, and an estimation of measurement accuracy will be provided. Some results of case studies, especially the comparison of radar data with results of one-dimensional convective cloud simulation, will be demonstrated in short form. With 10 figs., 1 tab., 29 refs.

14208 **(DOE/ER/60106—5) Lake ice occurrence as an early detector of climate perturbation: The potential for monitoring: Final report.** Barry, R.G. (Colorado Univ., Boulder (USA). Cooperative Inst. for Research in Environmental Sciences). Jan 1987. Contract AC02-83ER60106. 29p. NTIS, PC A03/MF A01. File Number DE87004503.

The utility of using records of lake freeze-up/break-up as a proxy indicator of transition season temperatures was investigated. Data for lakes and nearby meteorological stations in Canada and Finland were analyzed by simple regression techniques. Typically, a 3 to 10 day change in freeze-up/break-up date corresponds to a 1°C change in surface air temperature of the same sign during fall/spring, respectively. The spring relationships are less strong due to other hydro-meteorological factors, but the regression equations remain consistent. Application of such a regression relationship for lakes in southern Finland to a 150-year record of break-up/freeze-up at Lake Kallavesi shows a good fit to observed November and April temperature trends at Helsinki. The feasibility of monitoring lake ice conditions using operational satellite data was also studied by analyzing visible band DMSP images for Canada and Finland. In both regions, extensive fall season cloud cover and difficulties in discriminating dark ice types appear to limit this approach. For spring break-up the satellite-determined dates are generally several days later than the ground observations. Lakes of >40 km^2 and <800 km^2 show the most consistent results. The results confirm the value of data on lake ice conditions as a simple integrating measure of air temperature during transition season months. Large-scale monitoring of spring break-up date, at least, is feasible from operational meteorological satellites and could be used in helping to detect CO_2-induced climatic trends.

14209 (N—86-32348, pp vp) **Direct time series comparison between the La Jolla and Belfast radiocarbon records.** Sonett, C.P.; Suess, H.E. (California Univ., San Diego). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

For many years it has been widely assumed that the variations in the level of atmospheric carbon-14 were due to statistical fluctuations arising from experimental error. This is understandable since the signal/noise ratio is very low and the time sequences representing the variations are strongly stochastic. Interlaboratory comparisons show that baseline variations in the absolute value of the carbon-14 concentration do exist. However, assuming linearity, the delta ^{14}C values are independent of these. The importance of assessing the quantitive reality of the delta ^{14}C values is based upon their expression of the interplanetary cosmic ray source function, because in the range of 100 to 1000 year periods, there appears to be no evidence that the Earth's magnetic field is the source modulating function. Therefore the modulation is either due to changes in the solar atmosphere propagated out into the solar wind, or extra-heliospheric pressure effects, but these appear to be unlikely for the periods noted here. The recent availability of the new high quality Belfast time sequence of delta ^{14}C now permits a simple mutual assessment of the several sequences which are available. Since the La Jolla record has been a standard for many years , these two were chosen for a simple comparison. Although differences exist, the close agreement between these two sequences, one carried out on White mountain Bristlecone pines, and the other done using Irish peat bog wood, is striking. This correlation between the two strongly reinforces the statistical view that the delta ^{14}C record is that of real interplanetary modulation of the cosmic ray source leading to the generation of atmospheric ^{14}C.

14210 (N—86-32897, pp vp) **Trace gas effects on climate.** Ramanathan, V.; Callis, L.B.,JR.; Cess, R.D.; Hansen, J.E.; Isaksen, I.S.A.; Kuhn, W.R.; Lacis, A.; Luther, F.M.; Mahlman, J.D.; Reck, R.A. 1985. NASA, Goddard Space Flight Center, Code 610, Greenbelt, MD 20770 HC free; NTIS HC A23/MF A01. (NASA-TM—89236; NAS—1.15:89236).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change, volume 3.

The two primary objectives are to describe the new scientific challenges posed by the trace gas-climate problem and to summarize current strategies, and to make an assessment of the trace gas effects on troposphere-stratosphere temperature trends. Numerous reports on CO_2-climate problems are examined with respect to climate modeling issues. The role of the oceans in governing the transient climate response to time varying CO_2 concentrations is discussed.

14211 (N—86-32897, pp vp) **Spectroscopic database.** Husson, N.; Barbe, A.; Brown, L.R.; Carli, B.; Goldman, A.; Pickett, H.M.; Roche, A.E.; Rothman, L.S.; Smith, M.A.H. 1985. NASA, Goddard Space Flight Center, Code 610, Greenbelt, MD 20770 HC free; NTIS HC A23/MF A01. (NASA-TM—89236; NAS—1.15:89236).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change, volume 3.

Several aspects of quantitative atmospheric spectroscopy are considered, using a classification of the molecules according to the gas amounts in the stratosphere and upper troposphere, and reviews of quantitative atmospheric high-resolution spectroscopic measurements and field measurements systems are given. Laboratory spectroscopy and spectral analysis and prediction are presented with a summary of current laboratory spectroscopy capabilities. Spectroscopic data requirements for accurate derivation of atmospheric composition are discussed, where examples are given for space-based remote sensing experiments of the atmosphere: the ATMOS (Atmospheric Trace Molecule) and UARS (Upper Atmosphere Research Satellite) experiment. A review of the basic parameters involved in the data compilations; a summary of information on line parameter compilations already in existence; and a summary of current laboratory spectroscopy studies are used to assess the data base.

14212 (N—87-10263, pp vp) **Observation of atmospheric ozone by DIAL with Raman lasers pumped by a KrF laser.** Maeda, M.; Shibata, T. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8608134—).

From 13. international laser radar conference; Toronto, Canada (11 Aug 1986).

Since the XeCl excimer laser (308 nm) was first used in Differential Absorption Lidar (DIAL) for stratospheric ozone detection, the XeCl ozone lidar became a useful tool for the monitoring of the stratospheric ozone concentration. Shorter wavelength lasers are needed for the observation of ozone in the troposphere where the ozone concentration is about one order of magnitude smaller than in the stratosphere. In 1983, tropospheric ozone was observed with the combination of the second Stokes line (290.4 nm) of stimulated Raman scattering from methane pumped by a KrF laser and the XeCl laser line. The measurement of the ozone distribution from ground to 30 km was reported, using three Stokes lines of Raman lasers pumped by a KrF laser. At wavelengths shorter than 295 nm, the background solar radiation is effectively suppressed by atmospheric ozone. Such a solar-blind effect can be expected when two wavelengths 277 and 290.4 nm are used for DIAL ozone de-

tection. A preliminary measurement of the day time ozone distribution in the troposphere is presented using these wavelengths generated by a KrF laser with a Raman shifter. Analysis using the lidar equation predicts the maximum detectable range is 7 km.

14213 **(N—87-10612) Atmospheric ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change. Volume 1.** (National Aeronautics and Space Administration, Washington, DC (USA)). 1985. 505p. (NASA-TM—89237; NAS—1.15:89237). NTIS, PC A22/MF A01.

Global Ozone Research and Monitoring Project; Original contains color illustrations.

Topics addressed include: stratospheric chemistry; tropospheric trace gas (sources, distributions, and trends); tropospheric chemistry (processes, controlling the ozone and hydroxyl radicals); stratosphere-troposphere exchange; dynamic processes; and radiative processes (solar and terrestrial).

14214 (N—87-10612, pp vp) **Stratospheric chemistry.** Cox, R.A.; Demore, W.B.; Ferguson, E.E.; Lesclaux, R.; Ravishankara, A.R.; Sander, S.P.; Sze, N.D.; Zellner, R. 1985. NTIS, PC A22/MF A01. (NASA-TM—89237; NAS—1.15:89237).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change. Volume 1.

Recent improvements in the data base for the currently identified reactions describing the chemistry of the major families of trace gas species, HO(x), NO(x), ClO(x), and hydrocarbons are assessed. The important coupling reactions between the families are introduced progressively. Chemical aspects such as heterogeneous reactions and reactions of sodium species, the importance of which are not yet completely established, are discussed. Recent attempts to reconcile some of the more unexpected kinetic behavior which has emerged from the extensive experimental studies of key reactions with current reaction rate theory are also examined. The uncertainties in the current kinetic and photochemical data base is given. The prospects for improvement of data for known reactions of atmospheric importance as well as for the identification of gaps in the chemical description of the atmosphere.

14215 (N—87-10612, pp vp) **Tropospheric trace gases.** Gammon, R.; Wofsy, S.C.; Cicerone, R.J.; Delany, A.C.; Harriss, R.T.; Khalil, M.A.K.; Logan, J.A.; Midgley, P.; Prather, M. 1985. NTIS, PC A22/MF A01. (NASA-TM—89237; NAS—1.15:89237).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change. Volume 1.

Trace gas concentrations in the atmosphere reflect in part the overall metabolism of the biosphere, and in part the broad range of human activities such as agriculture, production of industrial chemicals, and combustion of fossil fuels and biomass. There is compelling evidence that the composition of the atmosphere is now changing. Observed trends in trace gas levels are reviewed and implications for the chemistry of the atmosphere are discussed. Throughout the discussion, particular emphasis is given to those species which are now increasing in the atmosphere.

14216 (N—87-10612, pp vp) **Tropospheric chemistry.** Mohnen, V.A.; Chameides, W.; Demerjian, K.L.; Lenschow, D.H.; Logan, J.A.; Mcneal, R.J.; Penkett, S.A.; Platt, U.; Schurath, U.; Dias, P.D. 1985. NTIS, PC A22/MF A01. (NASA-TM—89237; NAS—1.15:89237).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change. Volume 1.

The chemistry of the background troposphere, the source region, and the transition regions are discussed. The troposphere is governed by heterogeneous chemistry far more so than the stratosphere. Heterogeneous processes of interest involve scavenging of trace gases by aerosols, cloud and precipitation elements leading to aqueous phase chemical reactions and to temporary and permanent removal of material from the gas phase. Dry deposition is a major removal process for ozone, as well as for other gases of importance in tropospheric photochemistry. These processes are also discussed.

14217 **(PB—87-100681/XAB) Workshop report on the Complex Terrain Model Development project (February 4-6, 1986).** Lavery, T.F.; Strimaitis, D.; Egan, B. (Environmental Research and Technology, Lexington, MA (USA)). Sep 1986. 88p. NTIS, PC A05/MF A01.

The Complex Terrain Model Development project is being sponsored by the U.S. Environmental Protection Agency (EPA) to develop atmospheric dispersion models to simulate air pollutant concentrations in complex terrain that result from emission from large sources. In early October 1985, an initial version of the Complex Terrain Dispersion Model (CTDM) was delivered to EPA. A major step in the evaluation of CTDM was a workshop conducted in February 1986. Each participant was provided a diskette or tape of the CTDM code and a draft User's Guide and was asked to exercise the model to assess its overall effectiveness and validity.

14218 **(PB—87-102497/XAB) EPA (Environmental Protection Agency) complex-terrain model: theoretical basis and preliminary evaluation.** Perry, S.G.; Schiermeier, F.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Sep 1986. 23p. (EPA—600/D-86/218). NTIS, PC A02/MF A01.

The theoretical basis, physical structure, and preliminary evaluation of the U.S. Environmental Protection Agency's Complex Terrain Dispersion Model (CTDM) are described. CTDM is a point-source plume model designed primarily to estimate windward-side surface concentrations on distinct terrain features during stably-stratified flow. The model is based on steady-state, Gaussian diffusion assumptions. Potential flow theory is the basis of the model mechanisms for accounting for terrain-induced alterations in the flow. The model incorporates the critical dividing streamline height concept to separate the flow capable of surmounting the terrain from that restrained to flow around the terrain. Consideration is given to plume meander, source-induced effects on initial diffusion, and alterations in diffusion rates by flow deformation. Preliminary evaluations of the current version of the model with field tracer data and fluid modeling data show that CTDM can identify maximum concentrations with some success but that further refinements are warranted.

14219 **(PB—87-103032/XAB) Full-scale plume study: a summary of data collected and phenomena observed.** Lavery, T.; Holzworth, G.; Schiermeier, F.; Snyder, W.; Truppi, L. (Environmental Research and Technology, Inc., Concord, MA (USA)). Sep 1986. 13p. NTIS, PC A02/MF A01.

The paper briefly describes the field tracer studies that were conducted in support of EPA's Complex Terrain Model Development project. A more detailed description is given of the last field study, conducted from the Tracy Power Plant near Reno, Nevada. During 14 experiment periods, 128 hours of dual-tracer samples were collected at up to 100 locations. These concentration measurements were supported by conventional meteorological information as well as information from lidars and monostatic and doppler acoustic sounders. Finally, the paper describes some typical but complex flow patterns that occurred during stable conditions in the irregular terrain of the study area.

14220 **(PB—87-104006/XAB) Development of an atmospheric aerosol model for studies of global budgets and effects of airborne particulate material.** Giorgi, F. (National Center for Atmospheric Research, Boulder, CO (USA)). 1986. 247p. (NCAR/CT—102). NTIS, PC A11/MF A01.

A microphysics-removal atmospheric aerosol model (AAM) is developed for use in general circulation models (GCMs) to study global budgets and effects of particulate material. In this model the particle population is composed of a set of log-normal modes whose time evolution due to microphysical processes is described via prognostic equations for an appropriate number of moments of the particle-size distribution. Detailed parameterizations of particle coagulation, sedimentation, dry deposition, and wet removal are developed and implemented into the AAM. The AAM is incorporated into a GCM and is applied to two types of studies: (1) characteristics of the particle wet and dry removal processes, and (2) climatic impact of massive particulate injections following a global nucle-

ar war, with emphasis on the sensitivity of the simulated effects to the inclusion of particle microphysics. Results are discussed.

14221 **(PB—87-104501/XAB) Streamlines in stratified flow over a three-dimensional hill.** Thompson, R.S.; Shipman, M.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 5p. (EPA—600/D-86/235). NTIS, PC A02/MF A01.

A fluid modeling study was performed in the EPA Fluid Modeling Facility's stratified towing tank to determine the effects of stratification on the flow field over a three-dimensional hill. Streamlines in the stratified flow over an axisymmetric hill were marked with a dye tracer and photographed with a two-camera system. The trajectories on the photographs were digitized and processed by computer to determine the amount of deflection of the streamlines as they pass around the hill and the closest approach of each to the hill surface. A range of approach flow Froude number from 1.0 to 8.0 based on the hill height and neutral flow were modeled.

14222 **(PB—87-104634/XAB) Convective diffusion-field measurements compared with laboratory and numerical experiments.** Briggs, G.A.; Eberhard, W.L.; Gaynor, J.E.; Moninger, W.R.; Uttal, T. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 7p. (EPA—600/D-86/236). NTIS, PC A02/MF A01.

Some of the more fundamental diffusion parameters measured in the CONDORS convective diffusion field experiment are compared with laboratory experiment and numerical modeling results by means of nondimensionalizations using convective scaling (i.e., mixing depth, z/sub i/, for length and w* for velocity). The CONDORS experiment used remote sensors, radar and lidar, to measure three-dimensional patterns of metalicized chaff and oil fog. The growth of the vertical standard deviation of plume distribution, sigma/sub z/, agrees quite well with the non-field results, approximating 0.6 w*t nearly to the point of limitation by capping at z = z/sub i/. The lateral standard deviation, sigma sub y, also tends to approximate 0.6 w*t for most elevated releases, while most surface releases show slower growth at large t that better approximates the non-field results. Surface patterns of crosswind-integrated concentration show remarkable agreement with the laboratory results, for the most part, although there is more variation in individual runs; peak values from elevated releases are on the order of 70% larger than conventional Gaussian model predictions.

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14223 **(AD-A—173021/7/XAB) Destruction of chlorinated hydrocarbons by catalytic oxidation.** Palazzolo, M.A.; Jamgochian, C.L.; Steinmetz, J.I.; Lewis, D.L. (Radian Corp., Research Triangle Park, NC (USA). Progress Center). Sep 1986. 154p. NTIS, PC A08/MF A01.

This report provides the results of a study conducted to determine the effectiveness of catalytic oxidation for destroying vapor-phase chlorinated hydrocarbons. The study was conducted on two pilot scale catalytic incinerator systems leased from vendors. One system employed a metal-oxide catalyst in a fluidized bed configuration. The other system used a fixed-bed proprietary catalyst, supplemented with UV light and ozone injection. Both systems were tested under a variety of temperatures and space velocities. The test vapor streams consisted of low concentrations (3 to 200 ppmv) mixtures of organic compounds, and included three streams that represented the emissions from air strippers used to treat contaminated groundwater at U.S. Air Force bases. The study results showed that the fluidized-bed catalytic incinerator system was capable of achieving total organic destruction efficiencies of greater than 98%. The UV/ozone catalytic system failed to achieve high destruction efficiencies; with ozone injection, total destruction was 75%; without ozone, the maximum destruction efficiency was 64%.

14224 **(AD-A—173812/9/XAB) Predicted NO_2 ir chemiluminescence in the natural atmosphere. Technical report, February-May 1986.** Adler-Golden, S. (Spectral Sciences, Inc., Burlington, MA (USA)). 13 May 1986. 14p. (SSI-TR—110). NTIS, PC A02/MF A01.

Results from the author's recent theoretical study of NO_2 ir chemiluminescence from the NO + 0 and NO + O_3 reactions are employed in a new upper atmospheric NO_2 ir radiance model. Predictions are made for altitude-dependent and column-integrated NO_2 chemiluminescent radiance in four vibrational bands, and comparison is made with previous model predictions.

14225 **(AD-A—173825/1/XAB) CRC (Coordinating Research Council) cross-correlation aircraft-engine emission test program.** (Coordinating Research Council, Inc., Atlanta, GA (USA)). Aug 1986. 64p. (CRC—547). NTIS, PC A04/MF A01.

The CRC sponsored a test program to compare the performance of aircraft emission-measurement systems. The tests were conducted at the FAA's National Aviation Facilities Experimental Center, Atlantic City, N.J. This report details the results of an analysis of the secured cross-correlation emissions data taken over five weeks by seven participants. Results of the participant-to-participant variability of the gaseous pollutants are provided for CO, CO_2, THC, and NOx at low and high concentration, and low or high power. Results for smoke indicate additional development effort is required to secure repeatable smoke data among participants. The smoke analysis was also limited by the small amount of data and the high levels which are no longer typical of current engine emission control technology.

14226 **(AD-A—174025/7/XAB) Arctic haze: natural or pollution. Progress report.** Rahn, K.A.; Lowenthal, D.H. (Rhode Island Univ., Narragansett (USA). Center for Atmospheric Chemistry Studies). 1 Nov 1986. 159p. NTIS, PC A08/MF A01.

A 3-year program of continued research on Arctic haze is planned. The research builds on the accomplishments of the past three years and extends them, with particular emphasis on strengthening the new elemental tracer system, attempting to determine the history of Arctic haze by analyzing the Russian/Norwegian ice core from Nordauslandet, and analyzing aircraft samples from the AGASP II aircraft experiment of spring 1986. The tracer system will be improved in at least three ways: its statistical aspects will be refined, innovative ways of deriving signatures from hard-to-sample areas will be explored, and the tracer power of several noble metals will be determined. From the Nordauslandet core, as many as 100-200 samples will be analyzed for trace elements with the new technique developed under DOE sponsorship: the authors hope to use the results to write both the modern history of Arctic haze and the history of the various regions contributing to it. An extensive set of aircraft samples from AGASP II will be analyzed for trace elements and compared with the results of other investigators.

14227 **(AD-A—174195/8/XAB) Smoke hazards resulting from the burning of shipboard materials used by the US Navy. Part 2. Interim report, 1 September 1979-31 August 1980.** Williams, F.W.; Zinn, B.T.; Browner, R.F.; Powell, E.A. (Naval Research Lab., Washington, DC (USA)). 1 Oct 1986. 41p. (NRL—8990-PT-2). NTIS, PC A03/MF A01.

Physical and chemical properties of smoke particulates generated during combustion were determined for a polyphosphazene foam being considered for use as a thermal and acoustic insulation material in submarines. Study results indicate that, during nonflaming combustion, this polyphosphazene foam produces smoke particles with a log-normal size distribution and a mean diameter of approx. 0.45 microns; during flaming combustion, it produced black smoke consisting of nonspherical soot aggregates with a mean particle diameter between 0.9 and 1.2 microns. The greatest light obscuration was obtained under nonflaming combustion at a radiant flux of 7.5 W/cm sq. Results indicate that loss of visibility due to smoke formation during combustion of this form is considerably less than that obtained with PVC-nitrile rubber insulation. Chemical analysis of the smoke particulates generated during nonflaming combustion indicated the presence of aliphatic hydrocarbons, oxygenated ali-

phatic hydrocarbons, aliphatic nitriles, polynuclear aromatic hydrocarbone, and oxygenated aromatic compounds. Organophosphorus compounds were not detected. The expected level of hydrogen cyanide is well below the amount likely to produce acute toxic hazard to personnel exposed to gases in a fire.

14228 **(AD-A—174285/7/XAB) Operational use of air-pollution models at the space and missile ranges. Final report.** Boyd, B.F.; Bowman, C.R. (Eastern Space and Missile Center, Patrick AFB, FL (USA)). 15 Nov 1986. 11p. (ESMC-TR—86-01). NTIS, PC A02/MF A01.

The Space Shuttle exhaust ground and cloud results from the exhaust plume from the Space Shuttle Main Engines and the Solid Rocket Boosters initially impinging on the launch complex and flame trench. The initial ground cloud is formed from high-temperature combustion products and vaporized flame trench water. The exhaust cloud rises to an altitude at which buoyant equilibrium with the ambient atmosphere is established. This occurs at an altitude of 1 to 2 km in a period of 5 to 10 min after launch. At this point, the kinematic transport phase commences. At stabilization, the exhaust cloud typically contains approximately 99% ambient air entrained during the cloud rise portion of its transport. The major rocket exhaust constituents are hydrogen chloride (HCL),carbon dioxide (CO_2), water vapor (H_20), and aluminum oxide (Al_2O_3). The REEDM (Rocket Exhaust Effluent Diffusion Model) computer code is currently used to provide a real-time dispersion prediction during each launch of the Space Shuttle at the Eastern Test Range (ETR). It has also been used to assess the environmental impact fof future Shuttle launches at the Western Test Range. The REEDM includes basic mathematical expressions for atmospheric dispersion models, and cloud-rise models for calculating the gravitational deposition of acid drops. Inputs are vehicle and other source parameters, meteorological parameters defining the state of the planetary boundary layer including turbulence parameters, and physical properties of the rocket exhaust cloud. This paper describes the model and discusses recent improvements in detail.

14229 **(BNL—31381-R2) Brookhaven National Laboratory Filter Pack System for collection and determination of air pollutants.** Daum, P.H.; Leahy, D.F. (Brookhaven National Lab., Upton, NY (USA)). Nov 1985. Contract AC02-76CH00016. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87003784.

A filter pack system for sampling trace constituents in the atmosphere from aircraft and ground based measurement platforms has been developed. The system simultaneously and quantitatively collects atmospheric aerosol, nitric acid and sulfur dioxide using three sequential filter stages. The aerosol filter can be analyzed for sulfate, nitrate, ammonium and hydrogen ions, and specifically for sulfuric acid. The nitric acid filter is analyzed for nitrate ion and the sulfur dioxide filter is analyzed for sulfate ion. Details of the procedures used for filter preparation, sampling, extraction and analysis are given. 7 refs.

14230 **(CONF-8409122—4) Climatological effects of atmospheric ozone: A review.** Wang, W.C. (Atmospheric and Environmental Research, Inc., Cambridge, MA (USA)). 1984. Contract AC02-81ER60023. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002271.

From Quadrennial ozone symposium; Halkidiki, Greece (3 Sep 1984).

The paper presents some results of model estimates of ozone (O_3) climatological effects. Specific issues involved in O_3 climate study and future research needs are discussed. (ACR)

14231 (CONF-8602100—Pt.1, pp 9, Paper 2.1) **Overview of measuring techniques to analyse crude gas and clean gas.** Wurz, D. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Technische Thermodynamik). 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

This contribution deals with three special cases of sampling for measurement of flue-gas constituents that are of interest in connection with flue-gas cleaning processes: 1. Dust load of drop-carrying gases, 2. Loading of flue gas with ammonia-containing materials, 3. SO/sub 3/ loading of flue gases. Particular importance is attributed to reliable sampling.

14232 (CONF-8602100—Pt.1, pp 7, Paper 2.5) **Measurement of metals in flue gases.** Mueller, R. (Eidgenoessische Materialpruefungs- und Versuchsanstalt fuer Industrie, Bauwesen und Gewerbe, Duebendorf, Switzerland). 1986. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE87751251.

From 3. annual conference of VDI-Gesellschaft Energietechnik and special meetings; Darmstadt, F.R. Germany (25 Feb 1986).

Loose-leaf collection.

Considerable portions of metal emissions often pass filters, as flue gas tests in recent years have shown. This is corroborated by some measurement results from waste incineration plants. The paper presents the results of investigations dealing with the choice of suitable adsorbents and the problem of homogenicity of exhaust gas fluxes. To investigate metal emissions it is necessary, apart from avoiding contaminations and loss of substance, to make use of proven adsorbents; in some cases measurements in different sites which will furnish a complete net are required. A precondition are sampling devices of a highly inertial nature for simultaneous determination of emissions in the form of dust and gas from a sample gas.

14233 **(DOE/PC/90518—1) Aerated and vibrated chute feeders for particulate materials: Quarterly technical report for the period 9/1/86 to 11/30/86.** Jackson, R. (Princeton Univ., NJ (USA). Dept. of Chemical Engineering). 1986. Contract FG22-86PC90518. 14p. NTIS, PC A04/MF A02; 1; GPO Dep. File Number DE87003906.

Aeration and vibration are expected to improve the performance of particulate feeders and other components of solids transport schemes. In this report, we discuss the general formulation of equations of motion for aerated or vibrated granular solids. In particular, equations, predictions and measurements for inclined chute flows are presented for situations in which aeration and vibration effects are negligible. These results form a basis with which aerated and vibrated flow performance can be compared.

14234 **(GSF—27/86) Atlas of the monitoring stations of Europe.** (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen, Neuherberg (Germany, F.R.). Projektgruppe Bayern zur Erforschung der Wirkung von Umweltschadstoffen (PBWU)). 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87751173.

Taking the particular role of air pollution in the context of the 'new type' forest decline into account air pollution monitory station included in this report are divided into forest monitoring stations and local/regional air pollution stations established in view of human health aspects. The information on monitoring stations covers sulphur dioxide, nitric oxides and ozone. Hydrocarbons are also included. The report encloses maps and lists of stations indicating elevation, latitude and longitude. Additionally, information on the observation program and the measurement procedure are given. More detailed descriptions can be found in national technical reports or, as far as the FRG is concerned, in the relevant VDI Standard Methods. Further information, e.g. about the affiliation of the station to national or international monitoring networks, is given in a separate column ('Bemerkungen').

14235 **(IC—85/48) Analytical model for dispersion of material in the atmospheric planetary boundary layer in presence of precipitation.** Mayhoub, A.B.; Etman, S.M. (International Centre for Theoretical Physics, Trieste (Italy)). May 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780512.

An analytical model for the dispersion of particulates and finely divided material released into the atmosphere near the ground is presented. The possible precipitation when the particles

are dense enough and large enough to have deposition velocity, is taken into consideration. The model is derived analytically in the mixing layer or Ekman boundary layer where the mixing process is a direct consequence of turbulent and convective motions generated in the boundary layer.

14236 (KNMI-WR—6-1) **Dry deposition parameterization in long range transport models.** Kulig, A. (Royal Netherlands Meteorological Inst., Der Bilt). 1986. 39p. (ETN—86-98501). NTIS, PC A03/MF A01.

Methods for the computation of surface deposition velocities of sulfur and nitrogen dioxide, and sulfate and nitrate particles are derived. The methods may be used in studies of long range (mesoscale and regional scale) pollution transport. The influence of friction velocity and stability of the atmosphere on aerodynamic resistance is discussed. The standard deposition velocities which consist of the surface resistance and resistance of the laminar sublayer adjacent to the surface, are estimated. Mean values of dry deposition velocities for terrain categories useful in long range transport models are proposed.

14237 (N—86-32892, pp vp) **Hydrogen species.** Schiff, H.I.; Burnett, C.; Carli, B.; Dezafra, R.; Evans, W.F.J.; Guthrie, P.D.; Hampson, R.F.; Heaps, W.; Jones, R.; Kley, D. 1985. NASA, Goddard Space Flight Center, Code 610, Greenbelt, MD 20770 HC free; NTIS HC A16/MF A01. (NASA-TM—89238; NAS—1.15:89238).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change, volume 2.

Measurements of the members of the HO(x) family (OH, HO_2, and H_2O_3) and their major source gases, H_2O, and CH_4 are discussed. Emphasis is placed on measurements which were made since the 1982 World Meteorologic Organization (WMO) report. Measurement techniques, available data, an assessment of data reliability, and a comparison of the data with theoretical distributions of stratospheric HO(x) species predicted from one and two dimensional photochemical models are discussed.

14238 (N—86-32897, pp vp) **Model predictions of ozone changes.** Johnston, H.S.; Kaufman, F.; Cicerone, R.J.; Kolb, C.E.; Prather, M.; Schmailzl, U.; Solomon, S.; Sze, N.D.; Wuebbles, D.J. 1985. NASA, Goddard Space Flight Center, Code 610, Greenbelt, MD 20770 HC free; NTIS HC A23/MF A01. (NASA-TM—89236; NAS—1.15:89236).

In Atmospheric Ozone 1985. Assessment of our understanding of the processes controlling its present distribution and change, volume 3.

The predictions of several one-dimensional models were examined for a number of prescribed scenarios in steady-state or time-dependent approximations. A small number of two-dimensional steady-state calculations for a limited number of scenarios were compared with the results of one-dimensional models. The sensitivity of the calculated predictions to the values of input parameters were examined in order to assess recognized uncertainties in these predictions.

14239 (N—87-10263, pp vp) **Lidar mapping of a mixture of aerosol concentrations in a varying atmosphere.** Kleiman, M.; Egert, S.; Cohen, A. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

In several recent applications dealing with lidar measurement of atmospheric pollution, two basic assumptions are made: (1) the investigated aerosol layer is the only particulate material within the scattering volume; and (2) the contribution of the gaseous atmosphere to the lidar backscattering signals can be estimated and deducted from the total backscattering measurements. In the method discussed a generalized method which allows the elimination of the above mentioned assumptions was developed using multiparameter lidar measurements. The different parameters can be several wavelengths, polarization of the scattered light, scattering angles, or any combination of these parameters. The basic requirements are given. The detailed derivations are presented and discussed.

14240 (N—87-10263, pp vp) **Three atmospheric dispersion experiments involving oil fog plumes measured by lidar.** Eberhard, W.L.; Mcnice, G.T.; Troxel, S.W. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The Wave Propagation Lab. participated with the U.S. Environmental Protection Agency in a series of experiments with the goal of developing and validating dispersion models that perform substantially better that models currently available. The lidar systems deployed and the data processing procedures used in these experiments are briefly described. Highlights are presented of conclusions drawn thus far from the lidar data.

14241 (N—87-10263, pp vp) **Detection of NO sub x,C_2H_4 concentrations by using CO and CO_2 lasers.** Gengchen, W.; Qinxin, K. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A laser, especially the infrared line tunable laser, opens up a new way to monitor the atmospheric environment, and already has gotten effective practical application. One of the most serious problems in open path remote measurement at atmospheric pressure is the broadening effect which leads to increased linewidths, spectral interferences, and, as a result, tends to reduce detection sensitivity, so measuring laser wavelengths should be selected carefully, and interaction between the measuring wavelength and gas to be measured must be known very well. Therefore, N_2O, No, NO_2, CH_4, NH_3 and C_2H_4 absorption properties at some lines of CO and CO_2 line tunable lasers were studied. The absorption coefficients of NO, NO_2, and C_2H_4; some results on detection of NO sub x, C_2H_4 concentrations in both laboratory and field; and selection of measuring wavelengths and error analysis are discussed.

14242 (N—87-10263, pp vp) **Spectroscopic aspects of differential method for sounding gas composition of the atmosphere.** Zuev, V.V.; Ippolitov, I.I.; Ponomarev, Y.N. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The problems concerning the dynamics of populations of the sounded atmospheric gas molecule levels taking into account the nonmonochromatic character of radiation, durations of exciting and sounding pulses, rates of relaxation of excited vibration-rotation states population along different channels in a natural multicomponent mixture of gases and air were investigated. The problems of spectroscopic software, completeness and accuracy of the initial spectroscopic information, information on channels and rates of relaxation from the viewpoint of developing specific schemes of sounding are discussed. The values of deviations of vibration-rotation level populations of some atmospheric molecules from their equilibrium value at simultaneous action of double frequency radiation on the sounding path and the corresponding dynamic variation of lidar return amplitude were estimated. The importance of nonlinear spectrosopic effects in the lidar return value variation at sounding radiation frequency equaling the resonance frequency of vibration-rotation transition in the problem on sounding the humidity profiles and concentrations of gaseous pollutants was also estimated.

14243 (N—87-10263, pp vp) **Chemical contamination remote sensing.** Carrico, J.P.; Phelps, K.R.; Webb, E.N.; Mackay, R.A.; Murray, E.R. (SRI International Corp., Menlo Park, CA). Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

A ground mobile laser test bed system was assembled to assess the feasibility of detection of various types of chemical contamination using Differential Scattering (DISC) and Differential Absorption (DIAL) Lidar techniques. Field experiments with the

test bed system using chemical simulants were performed. Topographic reflection and range resolved DIAL detection of vapors as well as DISC detection of aerosols and surface contamination were achieved. Review of detection principles, design of the test bed system, and results of the experiments are discussed.

14244 **(N—87-11353) Computational solution of atmospheric chemistry problems. Final report, period ending 31 December 1985.** Jafri, J.; Ake, R.L. (Old Dominion Univ., Norfolk, VA (USA)). Aug 1986. 80p. (NASA-CR—179803; NAS—1.26:179803). NTIS, PC A05/MF A01.

Extensive studies were performed on problems of interest in atmospheric chemistry. In addition to several minor projects, four major projects were performed and described (theoretical studies of ground and low-lying excited states of ClO_3; ground and excited state potential energy surfaces of the methyl peroxy radical; electronic states ot the FO radical; and theoretical studies SO_2 (H_2O) (sub n)).

14245 **(PB—87-100608/XAB) Stomatal conductance and transpirational responses of field-grown cotton to ozone.** Temple, P.J. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). 1986. 9p. NTIS, PC A02/MF A01.

Stomatal conductance and transpiration were measured on normally-irrigated and water-stressed field-grown cotton (Grossypium hirsutum) exposed throughout the growing season to a gradient of ozone (O_3) concentrations. Environmental conditions during the growing season strongly affected stomatal responses and yield redutions due to O_3 exposure. Maximum stomatal conductance and transpiration decreased with increased O_3 concentration both in NI and WS treatments. Reductions in conductance and transpiration in O_3-stressed plants were attributed to inhibition of photosynthesis by O_3, leading to accumulation of CO_2 in intercellular spaces.

14246 **(PB—87-100665/XAB) Evaluation of air pollution abatement systems for multiple-hearth sewage sludge incinerators.** Annamraju, G.; Gerstle, R.W.; Shah, Y.M.; Arora, M.L. (PEI Associates, Inc., Cincinnati, OH (USA)). Sep 1986. 20p. NTIS, PC A02/MF A01.

From Presented at the annual Air Pollution Control Association conference; Minneapolis, MN, USA (22-27 Jun, 1986).

Capital and annual costs were calculated for the application of six different air-pollution-control system options to municipal sewage-sludge incinerators that were using multiple-hearth furnaces. The systems involved three principal types of air-pollution equipment - wet scrubbers, fabric filters, and electrostatic precipitators - applied to three different plant sizes (plants incinerating 36, 72, and 300 tons of dry sludge per day in one, two, and eight multiple-hearth furnaces, respectively). The six options were: (1) venturi/tray scrubber with a 40-inch pressure drop, (2) fabric filter system operating at 500 deg and equipped with an upstream temperature control, (3) fabric filter system operating at 500 deg and equipped with a heat exchanger and a scrubber for SO_2 reduction, (4) electrostatic precipitator (ESP) with upstream limited temperature and humidity control, (5) same as Option 4 but with an additional downstream wet scrubber for SO_2 reduction, and (6) ESP with upstream temperature control and an SO_2 scrubber. Technical feasibility studies indicated that all three types of controls could achieve a total particulate removal efficiency of 99 percent. The venturi/tray scrubber option entailed the lowest capital cost, but annual operating costs were highest because of the high pressure drops and increased energy use.

14247 **(PB—87-101754/XAB) Industrial-hygiene summary report. Occupational exposure to polychlorinated biphenyls at six commercial facilities, 1976-1977.** Roberts, D.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Apr 1986. 49p. NTIS, PC A03/MF A01.

A survey of occupational exposure to polychlorinated biphenyls (PCBs) was conducted. Personal and area samples were analyzed for PCBs at six facilities: a producer of PCBs, an electrical transformer manufacturer, a renovator of transformers, and three electrical capacitor manufacturers. Average personal exposures ranged from 30.5 to 640 micrograms per cubic meter (microg/m^3), the highest exposure occurring at a manufacturer of large and small capacitors utilizing Arochlor-1016 (12674112). The OSHA standard for PCBs containing 42 percent chlorine is 1 milligram/m^3. The NIOSH recommended standard is 1microg/m^3. Average area exposures ranged from 34 to 237microg/m^3. The facilities with the highest average exposures tended to have a greater number of PCB handling operators. The author concludes that airborne PCB exposures at the facilities were generally below the OSHA standards, but exceeded the NIOSH standard. Recommendations were made.

14248 **(PB—87-102398/XAB) Air and Energy Engineering Research Laboratory (AEERL) procedures manual: Level 1 environmental assessment terrestrial ecological tests. Final report, March 1980-October 1982.** Gezo, T.A.; Brusick, D.J. (Litton Bionetics, Inc., Kensington, MD (USA)). Sep 1986. 65p. NTIS, PC A04/MF A01.

The manual provides detailed procedures for EPA/AEERL's Level 1 terrestrial bioassays. (Some test methods designated for AEERL's Level 1 environmental assessment biological testing program are sufficiently new that little or no published literature is available describing specific application of the procedures.) The manual supplements the IERL-RTP Procedures Manual: Level 1 Environmental Assessment Biological Tests (second edition, EPA-600/8-81-024, NTIS No. PB 82-228966) which provides the basic procedural steps. The protocols described in the manual are the same as those in the supplemented manual, but are expanded in those areas of methodology which involve culturing methods, materials and supplies, and specific scoring procedures. The three tests included in the manual are: (a) Plant Stress Ethylene Test, to assess the toxic effects of gaseous samples on plant foliage; (b) Root Elongation Test, to determine the toxic effects of liquid samples and aqueous leachates on seed germination and root elongation in a number of plant species; and (c) Insect Toxicity Test, to measure lethality and reproductive toxicity in Drosophila melanogaster.

14249 **(PB—87-102513/XAB) EPA's (Environmental Protection Agency's) role in the quality assurance of ambient air-pollutant measurements.** Puzak, J.C.; McElroy, F.F. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). Sep 1986. 25p. (EPA—600/D-86/213). NTIS, PC A02/MF A01.

EPA's roll in the quality assurance of monitoring data is to assist monitoring agencies by providing those quality-assurance services or functions that (1) are common to most monitoring agencies and would be uneconomical to duplicate in each agency's program, (2) are too costly for individual monitoring agencies to carry out, (3) need to be uniform across the nation's monitoring agencies to facilitate universal data interpretation, comparison, evaluation, and common analysis, or (4) are more appropriately derived from a source independent from the monitoring agency. These functions are focused in three principle areas: (1) standardized and validated monitoring methods, (2) air monitoring guidance and technical assistance, and (3) assessment of the quality of monitoring data being obtained. These functions are discussed along with overview descriptions and summaries of results of specific EPA quality assurance programs including reference and equivalent methods, the Quality Assurance Handbook and other guidance documents, availability of various pollutant concentration standards, and assessment and reporting of the precision and accuracy of air monitoring data.

14250 **(PB—87-103438/XAB) Industry-wide studies report: a walk-through survey of C. R. Bard, Inc., Murray Hill, New Jersey.** Stayner, L.; Morawetz, J.S. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Industrial Hygiene Section). May 1986. 37p. (IWS—67.43). NTIS, PC A03/MF A01.

The primary objective of the survey was to assess the feasibility of including the facility in the NIOSH mortality and industrial hygiene study of workers exposed to ethylene oxide (ETO). During the survey, industrial hygiene and personnel records were evaluated, and a walk-through survey of the plant was conducted in order to observe all production processes with potential for ETO exposure. Industrial-hygiene monitoring for ETO was initiated in

1976. Personnel records were found to be adequate for the purposes of the mortality study. The facility meets all of the eligibility requirements as defined by the protocol, and therefore should be included in the NIOSH study. These requirements are (a) the plant must contribute at least 400 person-years, (b) the plant must have adequate personnel records or other records that can be used for identifying past and present workers exposed to ETO, and (c) the plant must not have any serious confounding exposure to a known leukemogen.

14251 **(PB—87-103586/XAB) Complex-Terrain Dispersion Model.** Strimaitis, D.G.; DiCristofaro, D.C.; Lavery, T.F. (Sigma Research Corp., Lexington, MA (USA)). Sep 1986. 18p. NTIS, PC A02/MF A01.

The paper describes the current state of EPA's Complex Terrain Disperson Model (CTDM), which has been under development during the past five years. The CTDM employs the concept of a dividing streamline height (a function of wind and temperature profiles), below which plume segments pass round the sides of a hill and/or above which they pass up and over the top. The model is currently constrained to simulate concentrations on the windward side of isolated terrain. The paper includes a comparison of CTDM concentration estimates with concentrations observed during a recent tracer study from a power plant in the Sierra-Nevada Mountains.

14252 **(PB—87-103982/XAB) Description of coupled general circulation models of the atmosphere and oceans used for carbon dioxide studies. Technical note.** Washington, W.M.; VerPlank, L. (National Center for Atmospheric Research, Boulder, CO (USA). Atmospheric Analysis and Prediction Div.). Aug 1986. 36p. (NCAR-TN—271-EDD). NTIS, PC A03/MF A01.

The report describes three coupled atmosphere/ocean models that are being used at NCAR for studies of climate sensitivity to increased CO_2 concentrations. The atmospheric model was adapted from the original version of the NCAR Community Climate Model which was based on the Austrialian spectral model. The model has been modified by adding a substantially revised radiation/cloudiness scheme and then run with perpetual January and July simulations. To make the model suitable for CO_2 studies, it was modified to include an optional seasonal cycle, with predictions of soil moisture, snow cover, and sea ice. Also, three different types of ocean models were made optional features.

14253 **(PB—87-103990/XAB) Initialization of the PSU/NCAR (Pennsylvania State University/National Center for Atmospheric Research) mesoscale mode. Technical note.** Errico, R.M. (National Center for Atmospheric Research, Boulder, CO (USA). Atmospheric Analysis and Prediction Div.). Jul 1986. 133p. (NCAR-TN—270-IA). NTIS, PC A07/MF A01.

The report describes software designed to initialize a particular mesoscale model (MM4) developed for the Acid Deposition Modeling Project of the National Center for Atmospheric Research. The primary purpose of the initialization is to dynamically balance initial data for the MM4 so as to remove unrealistic inertial-gravitational oscillations from its forecasts. Analyzed data is modified so as to satisfy a dynamic balance condition. That condition is described by a system of nonlinear equations resembling a quasi-geostrophic w - equation coupled with a nonlinear balance equation and a potential vorticity constraint. The constraint is consistent with the theories of geostrophic adjustment and nonlinear normal-mode initialization. Although vertical structure functions are determined in order to easily invert relevant 3-D integral operators, no normal modes are determined.

14254 **(PB—87-104584/XAB) International sulfur deposition model evaluation.** Clark, T.L.; Dennis, R.L.; Seilkop, S.; Voldner, E.C.; Alvo, M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 7p. (EPA—600/D-86/225). NTIS, PC A02/MF A01.

From 5. joint conference on the Applications of Air Pollution Meteorology; Chapel Hill, NC, USA (17-21 Nov, 1986).

Eleven long-term sulfur deposition models are evaluated for each season of 1980 using screened precipitation-chemistry data from five North American networks. Two objectives of the model evaluation are (1) to identify which models best replicate the observed temporal and spatial patterns of sulfur wet deposition within data uncertainty limits (i.e., from measurement errors and spatial variability) and (2) to delineate for each model areas and periods of good and poor agreement with observations. Analyses indicated that the MOE, SERTAD and TVA models significantly under/overpredict in neither more than 20% of the evaluation region for any season nor in 25% of any of the four subregions. Many of the models replicated rather well the temporal pattern. However, the temporal patterns of the SIMPMOD and STATMOD models were significantly different.

14255 **(PB—87-104642/XAB) Evaluating O_3 predictions from a test application of the EPA Regional Oxidant Model.** Schere, K.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 8p. (EPA—600/D-86/221). NTIS, PC A02/MF A01.

The first-generation U.S. EPA Regional Oxidant Model (ROM1) was tested and evaluated for O_3 predictions on a two-day test case episode (3-4 August 1979) in the Northeast Regional Oxidant Study (NEROS) area. The two-day episode was characterized by relatively high O_3 concentrations in the southern Great Lakes area where clear skies persisted. Intermittent periods of relatively high O_3 levels existed near some of the eastern seaboard cities where partly cloudy skies alternated with clouds and showers in the vicinity of a stationary frontal zone. Model evaluation results for O_3 are presented in two stages. First, an analysis of model predictions at all hours of the simulation for all surface-monitoring site locations is performed. Results show an average underprediction of only a few percent. In the second stage, an analysis of the ability of the ROM1 to predict daily maximum concentrations, two aspects are considered in the evaluation analysis. First, the maximum O_3 concentrations at monitoring station locations are paired with the corresponding model predictions. Second, the model predictions are analyzed for individual urban emissions source-area plumes.

14256 **(PB—87-104972/XAB) Industrial-hygiene survey report of Borg Warner Chemicals, Inc., Woodmar Plant, Washington, West Virginia.** Roberts, D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1986. 27p. (IWS—147.26). NTIS, PC A03/MF A01.

Due to possible worker exposure to 1,3-butadiene, a walk-through industrial-hygiene survey was conducted at Borg Warner Chemicals Woodmar Facility, Washington, West Virginia. The primary products of the facility are ABS plastics, polybutadiene latex and styrene butadiene rubber latex. In September 1981, a butadiene recovery system was added to the process vent streams. Of the total work force, 54 employees have potential for exposure to 1,3-butadiene. The mean 8-hour time-weighted average (TWA) of 23 personal samples collected during several periods in 1983 and 1985 was 4.5 parts per million (ppm). Analysis of a bulk sample showed traces of 1,3-butadiene, in the 0.04 to 0.2 nanograms/milligram range. The exposures to 1,3-butadiene were greater than 10ppm for two job classifications, control room and high heat operators. The company has accurate records on terminated and current employees. The author concludes that the facility is a candidate for inclusion in an in-depth industrial hygiene survey regarding 1,3-butadiene. Recommendations were given.

14257 **(PB—87-105003/XAB) Health-hazard evaluation report HETA 86-179-1699, doctor Levin, Denver, Colorado.** Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1986. 14p. (HETA—86-179-1699). NTIS, PC A02/MF A01.

Employees of the Levin dental clinic, Boulder, Colorado, requested an evaluation of nitrous oxide and mercury exposures be made at the clinic. Nitrous oxide levels measured directly with an infrared gas analyzer showed levels during administration ranging from 0 to greater than 1000 parts per million (ppm). The average level in the dentist's breathing zone during a dental procedure lasting for about 1 hour was 200ppm. Mercury exposure was not found in the dental office or operatories. Interviews with the dentist and two dental assistants did not reveal any medical conditions compati-

ble with exposure to mercury or nitrous oxide. The author concludes that the dentist in the clinic was overexposed to nitrous oxide. Recommendations by the author include adjustments to the existing scavenging system and decreased use of nitrous oxide. It is also recommended that a check be made with the company who installed the scavenging system to determine if the vacuum rate could be increased to 45 liters/minute. All personnel should be made aware of the adverse health effects of overexposure to nitrous oxide.

14258 **(PB—87-105011/XAB) Health-hazard evaluation report HETA 86-173-1707, KP Industries, Delphos, Ohio.** Ruhe, R.L.; Todd, W.F. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1986. 17p. (HETA—86-173-1707). NTIS, PC A02/MF A01.

An evaluation of worker exposure to carbon monoxide (CO) fumes in the shipping and warehouse area, and to lead in the can line area was performed. The 8-hour time-weighted average (TWA) CO levels ranged from 64 to 74 parts per million (ppm); the OSHA 8 hour TWA permissible exposure limit is 50ppm. The CO levels resulted from the use of six propane forklift trucks and an inadequate distribution of airflow. Airborne CO concentrations behind the forklifts were as high as 350ppm. After tuning the trucks, the CO level was significantly reduced. Airborne lead concentrations for four personal and three area samples were less than 2 micrograms/cubic meter. The authors conclude that overexposure to CO occurred in the shipping and warehouse area. A health hazard from exposure to lead did not exist at the time of the evaluation. Recommendations were given.

14259 **(PB—87-105433/XAB) Industrial-hygiene summary report of asbestos-exposure assessment for brake mechanics. Industry-wide study.** Roberts, D.R.; Zumwalde, R.D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 22 Nov 1982. 39p. (IWS—32-4A). NTIS, PC A03/MF A01.

Personal and general-area air samples were collected and analyzed for both time-weighted average (TWA) and peak asbestos fiber concentrations to which brake mechanics would likely be exposed while on the job. Of the six facilities examined, two were automotive brake service shops, three were municipal garages, and one was a private fleet service garage. Asbestos-fiber content and size were determined from bulk samples. Of the 13 TWA's determined for mechanics, the NIOSH recommended limits of 0.1 fibers/cm^3 greater than 5 μm in length was exceeded in 8. However, even these 8 were within the current OSHA standards. With the exception of vacuum cleaning, all cleaning methods produced fiber levels near the NIOSH recommended ceiling, which is 0.5 fibers/cm^3. The OSHA ceiling limit, 10 fibers/cm^3, was exceeded twice when compressed-air cleaning was used. The authors made recommendations.

14260 **(PB—87-105466/XAB) Bay Area Asbestos Surveillance Project (BAASP). Draft final report.** Polakoff, P.L. (Western Inst. for Occupational/Environmental Sciences, Inc., Berkeley, CA (USA)). 15 Dec 1980. 69p. NTIS, PC A04/MF A01.

A study, the Bay Area Asbestos Surveillance Project (BAASP), was instituted to screen persons including women who had worked in shipyards during World War-II and male longshore and shipyard workers who believed they had been exposed to asbestos prior to 1963 in the San Francisco Bay area in California. The Project initiated a process of worker notification concerning asbestos-related disease in the shipyard and longshore industries, advanced public awareness of the hazards of asbestos, began to identify persons who experienced significant exposure to asbestos, and provided some assessment of the medical and social needs of asbestos exposed workers and their families. Of 2244 workers examined by x-ray, 46% showed potentially serious abnormality and 30% showed questionable abnormality. Of 208 longshoremen, 41% showed potentially serious abnormality and 20% showed questionable abnormality. Of 186 women, 26% showed potentially serious abnormality and 35% showed questionable abnormality. The author concludes that, at the very least, the results of the study emphasize again the importance of asbestos as a threat to many industrial workers.

14261 **(PB—87-105557/XAB) Health-hazard evaluation report HETA 84-117-1696, Martin Marietta Michoud Operations, New Orleans, Louisiana.** McConnell, R.S.; Markel, H.L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1986. 23p. (HETA—84-117-1696). NTIS, PC A02/MF A01.

Workers at the Martin Marietta Michoud Operations Facility, New Orleans, Louisiana requested an evaluation of asthma and liver function test abnormalities among workers in the Thermal Protection System (TPS) insulation areas with potential exposures to diphenylmethane-diisocyanate (MDI) and solvents. Three cases of probable MDI-induced asthma were identified. There was no detectable group decline in one second forced expiratory volume associated with MDI exposure. In general, environmental levels of MDI in company records were below 25ppm. Respiratory protection was worn by operators and sprayers where MDI was present. In the final assembly area, 9 of 103 workers had abnormal serum liver enzyme concentrations. The authors conclude that it is probable that some employees developed asthma as a result of exposure to MDI. Recommendations were given.

14262 **(PB—87-105565/XAB) Health hazard evaluation report HETA 84-058-1700, Hilton-Davis Chemical Company, Cincinnati, Ohio.** London, M.A.; Boiano, J.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1986. 37p. (HETA—84-058-1700). NTIS, PC A03/MF A01.

The International Chemical Workers Union requested an evaluation of occupational exposures to suspect bladder carcinogens at Hilton Davis Chemical Company, Cincinnati, Ohio. Of about 30 workers in the Pigments Department, four were involved in handling 3,3'-dichlorobenzidine (DCB). Personal breathing-zone air samples, area air samples, forearm gauze-patch samples, and wipe samples from various surfaces were gathered. All four personal breathing-zone air samples and three of four area air samples contained low but detectable quantities of DCB. Seven of eight skin-gauze samples contained 0.2 to 3.7 micrograms/25 cm^2 and 19 of 26 wipe samples showed 0.4 to 2800 micrograms/100 cm^2. Low, but measurable, concentrations of DCB were present in the urine of workers who performed the DCB charging operation. The authors conclude that a potential health hazard existed due to exposure to DCB. The authors recommend that appropriate ventilation should be used in the charge room.

14263 **(PB—87-105573/XAB) Health-hazard evaluation report HETA 85-527-1704, Canyon de Chelly National Monument, Chinle, Arizona.** Kerndt, P.R.; Apol, A.G. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1986. 20p. (HETA—85-527-1704). NTIS, PC A02/MF A01.

The National Park Service requested appropriate medical follow up for five employees who became ill after exposure to a granular pesticide applied in and around the visitor center at Canyon de Chelly National Monument, Chinle, Arizona on September 2, 1985, and to determine whether the subsequent decontamination of the center was adequate. On September 8 to 10, 1985, an environmental and medical survey was conducted. Analysis of a bulk sample of the pesticide confirmed the presence of malathion. Air samples contained less than 0.03 microg/m^3 of air. The OSHA Standard for malathion in the air is 15,000microg/m^3. No significant differences were noted for serum cholinesterase levels. Seven days following exposure, RBC cholinesterase levels of exposed employees were significantly lower when compared to follow-up levels. The authors conclude that employees were exposed to potentially toxic concentrations of malathion after application of the pesticide.

14264 **(PB—87-106506/XAB) Health hazard evaluation report HETA 84-419-1697, USGS Laboratory, Doraville, Georgia.** Rondinelli, R.; Wilcox, T.; Roper, P.; Salisbury. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1986. 33p. (HETA—84-419-1697). NTIS, PC A03/MF A01.

The U.S. Geological Survey National Water Quality Laboratory, Doraville, Georgia requested an evaluation of physical com-

plaints reported by employees to determine possible work related causes. Laboratory workers, in general, complained of physical symptoms which were irritative (rash, sore throat, nose or sinus irritation), neurological (numbness, muscle weakness) and nonspecific (dizziness, headache, emotional swings, insomnia, muscle aching, fatigue). Reported exposure to solvents such as benzene, methylene chloride, hexane and acetone were positively related with light headedness or dizziness, numbness, unexplained muscle weakness and muscle aching. Air sampling did not reveal any remarkable exposure to chemical contaminants. The authors conclude that no relationship could be established between chemical exposures and antinuclear antibody positivity. Exposure to chemicals measured by air sampling were below occupational health exposure limits.

14265 **(PB—87-107579/XAB) In-depth survey report: control technology for manual transfer of chemical powders at the B. F. Goodrich Company, Marietta, Ohio.** Gressel, M.G.; Heitbrink, W.A.; McGlothlin, J.D.; Fischbach, T.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Dec 1985. 103p. (ECTB-CT—149-33). NTIS, PC A06/MF A01.

A field study was conducted in the B.F. Goodrich Industrial Plastics Division facility, Marietta, Ohio to evaluate sources of worker dust exposure at a ventilated booth used for the weigh out and transfer of powdered materials from large drums to small bags. The sources of dust exposure evaluated were: depth of scooping, clothing, worker anthropometry, work practices, biomechanics, and specific items in the job cycle. Dust exposure for workers wearing clean clothing was not significantly different from exposure for workers wearing dirty clothing. Depth of scooping from the drum significantly affected dust exposure. There appeared also to be a relationship between the size of the worker and dust exposure when scooping from the bottom of the drum. Work practices may also play a part. The authors conclude that, while the results showed abnormally high dust levels, all three workers studied wore respirable dust respirators during the experiment to protect them from these high levels. Air flow patterns at the booth suggest that the ventillation provided may even contributed to dust exposure.

14266 **(PB—87-110409/XAB) Characteristics of lakes in the eastern United States. Volume 3. Data compendium of site characteristics and chemical variables.** Kanciruk, P.; Eilers, J.M.; McCord, R.A.; Landers, D.H.; Brakke, D.F. (Environmental Protection Agency, Washington, DC (USA). Office of Acid Deposition, Environmental Monitoring, and Quality Assurance). Jun 1986. 455p. (EPA—600/4-87/007C). NTIS, PC A20/MF A01.

A water sample was collected from each of 1612 lakes. This subset of lakes was selected from within three regions of the eastern U.S. (the Northeast, Upper Midwest, and Southeast) expected to exhibit low buffering capacity. Each region was divided in subregions. Subregions were further stratified by alkalinity map class. A suite of chemical variables and physical attributes thought to influence or be influenced by surface-water acidification was measured for each lake. The results of these measurements and data analyses are described in the report.

14267 **(PB—87-110474/XAB) Preliminary operation of the fluidized-bed combustion facility for hazardous-waste disposal research: test results and evaluation. Final report, October 1982-June 1985.** Clayton, R.; Dempsey, H.; Machilek, R. (Acurex Corp., Research Triangle Park, NC (USA)). Oct 1986. 227p. NTIS, PC A11/MF A01.

The report describes Phase I of a program to provide research data on the destruction of hazardous wastes in a fluidized-bed combustor (FBC). The report addresses three primary areas of the program: facility operation, sampling and analysis, and health and safety. The FBC was operated at a nominal temperature of 982 C for each test run. The bed height changed somewhat from run to run, but the residence time at a temperature of about 982 C was maintained at about 0.8 sec. CO and CO_2 concentrations in the freeboard were monitored continuously, along with downstream O_2 and total hydrocarbon levels. Operating parameters were maintained easily, but were less flexible than desired. Phase II of the program will re-evaluate and continue the research effort, based on the Phase I data and conclusions.

14268 **(PB—87-113742/XAB) EPA (Environmental Protection Agency) workshop on N_2O emission from combustion (Durham, NC, February 13-14, 1986). Report for December 1985-August 1986.** Lanier, W.S.; Robinson, S.B. (Energy and Environmental Research Corp., Chapel Hill, NC (USA). Eastern Operations Office). Sep 1986. 124p. NTIS, PC A06/MF A01.

The report summarizes the dialogue and interaction that took place during an EPA sponsored workshop addressing nitrous oxide (N_2O) emissions from fossil fuel combustion. Prior research had identified N_2O as a trace gas potentially contributing to depletion of stratospheric ozone as well as being a contributor to global climate change through the greenhouse effect. Prior studies also suggested that fossil fuel combustion was a major anthropogenic source of N_2O emissions. The workshop was organized to assess the current understanding of combustion generated N_2O emission and to assist EPA in formulating combustion-research activities. The four technical sessions addressed: (1) N_2O measurement, (2) N_2O formation/destruction mechanisms during combustion, (3) emission source prioritization, and (4) emission control approaches. It appears that the most significant N_2O emitters are utility and industrial boilers firing coal and heavy fuel oil.

14269 **(PB—87-113874/XAB) Operations handbook - ozone measurements to 40-km altitude with model 4A electrochemical concentration cell (ECC) ozonesondes (used with 1680-MHz radiosondes).** Komhyr, W.D. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Sep 1986. 58p. (NOAA-TM-ERL-ARL—149). NTIS, PC A04/MF A01.

Electrochemical concentration cell (ECC) ozonesondes are flown by balloon at a number of stations throughout the world to obtain data on atmospheric ozone vertical distributions to near 40-km altitude. The handbook gives information about the instrumentation (including the balloon vehicles), and provides instructions concerning preparation of the instruments for flight, data reduction, and data archiving. The instructions are intended to standardize operation of the instruments so that different users might obtain data of comparable quality.

14270 **(PB—87-114120/XAB) Indoor pollution control capabilities of a desiccant dehumidifier system. Final report, July 1985-August 1986.** Relwani, S.M.; Moschandreas, D.J. (IIT Research Inst., Chicago, IL (USA)). Aug 1986. 96p. (IITRI-C—08840-FR). NTIS, PC A05/MF A01.

The recent need to conserve energy by tightening the envelope of residences and reducing their ventilation rates may lead to an increase in the concentration of pollutants generated indoors. The program was initiated by GRI to assess a desiccant dehumidifier system as a means of reducing indoor-air-pollutant concentrations. Controlled experiments were performed using a commercially available desiccant rotary unit to study the adsorption capability of silica gel and molecular sieve 5A for CO, NO_2, and SO_2 air constituents. The values measured establish the range of removal rates of these constiuents for a specific unit design. The molecular sieve demonstrated higher adsorption capabilities for CO, NO_2, and SO_2 than did the silica gel. Factors that affect the desorption of the constituents from desiccants include regeneration air temperatures and inlet constituent concentrations. Higher regeneration air temperatures and lower pollutant concentrations favor the regeneration capabilities of desiccants. Silica gel showed better trends of regeneration than did molecular sieve 5A.

14271 **(PB—87-114690/XAB) Industry-wide studies report of an industrial-hygiene survey of Riverside Manor Nursing and Rehabilitation Center, Newcomerstown, Ohio.** Ringenburg, V.L.; Molina, D.; Elliott, L.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1986. 30p. (IWS—152-20). NTIS, PC A03/MF A01.

Occupational exposure of workers to ethylene oxide (EtO) was examined. Two of six side-by-side short-term personal breathing-zone (BZ) exposure levels, determined while the sterilizer operator unloaded the EtO sterilizer unit, exceeded NIOSH recommended short term levels of 5 parts per million (ppm) for any 10-

minute period per workday. Three of 12 personal BZ exposure levels exceeded the NIOSH recommended standard of less than 0.1ppm for an 8-hour time-weighted average. Measurable levels of EtO, ranging from 0.18 to 14.5ppm were detected in the storage room where the EtO sterilized items were aerated. The authors conclude that EtO exposure potential at the nursing and rehabilitation center could be reduced by improving administrative controls, work practices, and engineering controls. Recommended improvements were given.

14272 **(PB—87-114708/XAB) In-depth survey report: control technology for bag-filling operations at Company X.** Cooper, T.C. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1984. 40p. (ECTB—112-21B). NTIS, PC A03/MF A01.

Due to the use of several exemplary controls at the Company-X operation for packaging chrysotile asbestos fibers, a study was conducted at the facility to determine the effectiveness of the operation. Controls evaluated were: enclosures for the bag-filling and bag-flattening operations; exhaust ventilation from these enclosures; use of both shrink wrapping and stretch wrapping; automated palletizing; and isolation of the bagger rooms. There were approximately 60 employees at the milling and packaging site. The two packaging stations are isolated from each other and from other operations within the building. Packaging operations include bag filling, conveying, shrink wrapping of paper bags and palletizing. Effectiveness of the control methods for airborne fibers was evaluated quantitatively by taking airborne samples and ventilation measurements.

14273 **(PB—87-114724/XAB) Health-hazard evaluation report HETA 84-222-1715. TRW Bearings, Inc., Jamestown and Falconer, New York.** Hartle, R.W.; Singal, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 30p. (HETA—84-222-1715). NTIS, PC A03/MF A01.

United Automobile Workers Local 338 requested an evaluation of respiratory and skin problems among workers at TRW Bearings Division Facilities. The facilities grind and mill roller bearings for the automotive and aircraft industry. A free running synthetic coolant (usually a 1:25 coolant:water mixture) was used to reduce heat buildup within the bearing and the grinding wheel. The coolant systems in both facilities consisted of primarily oil fractions of aliphatic hydrocarbons, phenols, and nitrogen compounds. The microbiocide used contained several isothiazolin and chloro-nitrogen compounds. The rust inhibitor showed no major peaks under gas-chromatographic, mass-spectrometric analysis. Airborne exposures to oil mist or other substances were not in excess of current occupational health criteria. The authors conclude that the reason for the higher prevalence of skin problems is not clear. The authors made recommendations.

14274 **(PB—87-115036/XAB) Asbestos-in-buildings technical bulletin: abatement of asbestos-containing pipe insulation. Technical bulletin.** Keyes, D.L. (Battelle Columbus Labs., Washington, DC (USA)). 1986. 18p. NTIS, PC A02/MF A01.

The technical bulletin supplements information in the 1985 guidance document: Guidance for Controlling Asbestos-Containing Materials in Buildings (EPA-560/5-85-024). It addresses one type of ACM: asbestos-containing insulation on steam, hot-water, or cold-water pipes. Detailed procedures are presented for repairing or removing pipe insulation or removing the insulation and pipe together.

14275 **(PB—87-115119/XAB) Toxicity of particles emitted from combustion of waste crankcase oil: in -itro and in-vivo studies.** Mumford, J.L.; Hatch, G.E.; Hall, R.E.; Jackson, M.A.; Merrill, R.G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). 1986. 11p. (EPA—600/J-86/175). NTIS, PC A02/MF A01.

The ever-rising cost of energy provides incentives for the utilization of waste crankcase oil (WCO) for space heating. The potential health hazards of emissions and waste products resulting from the combustion of WCO are unknown. The toxicity of the emission particles and waste products from two different types of burners, a Dravo atomizing oil burner (AOB) and a Kroll vaporizing oil burner (VOB), are evaluated using automotive WCO. Samples are characterized by performing elemental analysis and scanning electron microscopy. The toxicity of AOB emission particles, VOB emission particles, and VOB waste residue is evaluated in three bioassay systems, i.e., a rabbit alveolar macrophage cytotoxicity in vitro assay, an intratracheal injection infectivity assay, and a peritoneal irritancy test in mice. Emission particles from both burners are comparable in overall potency to the most toxic combustion particles tested previously, with the exception of AOB particles in the infectivity assay.

14276 **(PB—87-115671/XAB) Discussion (research issues to facilitate risk assessment of toxic air pollutants).** Graham, J.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Sep 1983. 6p. (EPA—600/J-83/353). NTIS, PC A02/MF A01.

Given the excellence of the Critical Review of Toxic Air Pollutants, this discussion expands on a few points raised by Dr. Goldstein rather than critique his comments. Because Dr. Goldstein and the other discussants addressed carcinogenesis issues so well, the author here limits her comments to noncarcinogenic endpoints. Focus is placed on health research elements that feed into risk assessment using the basic premise that a risk assessment can be no better than the data being assessed. The discussion is organized according to the elements of research risk assessment and risk management described by Dr. Goldstein and the National Academy of Sciences panel. Dr. Goldstein's convention of TAP, standing for Toxic Air Pollutants, is used.

14277 **(PB—87-116406/XAB) Remaining issues over hazardous-waste thermal destruction.** Oppelt, E.T. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Oct 1986. 20p. (EPA—600/D-86/243). NTIS, PC A02/MF A01.

Since 1980, the U.S. Environmental Protection Agency (EPA) has conducted extensive research to assess the performance of hazardous-waste thermal-destruction processes. Some members of the scientific and the environmental action community remain concerned about the long-term safety of the technology. The issues most frequently raised pertain to the possibility that harmful levels of heavy metals and incomplete combustion by-products may still be emitted from thermal-destruction facilities that are otherwise meeting the current RCRA standards. This paper summarizes the most recent data on thermal-destruction facility performance with particular attention to metal and organic by-product emissions. Ongoing EPA research in the area and in real-time monitoring are discussed. Real versus perceived concerns over thermal destruction is put in perspective.

14278 **(PB—87-116414/XAB) Hybrid-receptor modeling.** Stevens, R.K.; Lewis, C.W. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 8p. (EPA—600/D-86/238). NTIS, PC A02/MF A01.

A hybrid-receptor model is a specified mathematical procedure that uses not only the ambient-species concentration measurements that form the input data for a pure receptor model, but, in addition, source emission rates or atmospheric dispersion or transformation information characteristic of dispersion models. By utilizing more information, hybrid receptor modeling promises improved source apportionment estimates or, more fundamentally, consideration of problems that are inaccessible in terms of classical-receptor modeling. Two examples of hybrid-receptor models are reviewed to illustrate the variety in possible approaches. Some hybrid-receptor modeling results are given for the comprehensive ambient-source meteorological data base collected at Deep Creek, Maryland, during summer 1983. By using source and ambient measurements of selenium, about 33% of the sulfate impact at the receptor site during a day-time period can be associated with emissions from a coal-fired power plant 50 km upwind.

14279 **(PB—87-116422/XAB) Look at the influence of building orientation on plume dispersion in the wake of a building.** Huber, A.H. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Oct 1986. 8p. (EPA—600/D-86/241). NTIS, PC A02/MF A01.

Observations of mean pollutant-concentration profiles downwind of a block-sized model building are reported. These data are part of a more-comprehensive field-model study of building wake effects conducted in the U.S. Environmental Protection Agency's Fluid Modeling Facility. The study includes point measurements of pollutant concentration, velocity, turbulence, and full-video images of smoke-visualized plumes. The building orientation can have a significant effect on the maximum ground-level concentrations near a building. Slight angles were observed to result in the maximum being increased by a factor of 2-3 at x=3H. Concentrations were only increased by a factor of 1.5 at x=10H. The pattern of concentrations can be well explained by expected enhanced turbulence, vortex flow, and streamline convergence observed in previous studies.

14280 **(PB—87-116786/XAB) Health-hazard evaluation report HETA 84-405-1717, NIOSH Ridge Building, Cincinnati, Ohio.** Reed, L.D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 20p. (HETA—84-405-1717). NTIS, PC A02/MF A01.

Methylene-bisphenyl-isocyanate (MDI) and organic-solvent exposures were investigated during the application of a polyurethane roofing system at the NIOSH Ridge Building, Cincinnati, Ohio. MDI monomer concentration in area samples ranged from nondetected to 74 microgram/cubic meter (microg/m^3), while total reactive isocyanate group concentrations ranged from nondetected to 338 microg/m^3. Four of eight personal samples collected for MDI monomer showed positive results, with concentrations ranging from 2 microg/m^3 to 3.9 microg/m^3; comparison of sampling and analytical methods used suggested that the exposure may have been underestimated by a factor between 25 and 50. The author concludes that the data strongly suggess overexposures to monomeric MDI and total isocyanates occurred during roofing application. They recommend that positiv-pressure-supplied air respirators should be used when applying polyurethane roofing.

14281 **(PB—87-117016/XAB) Health-hazard evaluation report HETA 86-034-1712, C F and I Steel, Pueblo, Colorado.** Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 11p. (HETA—86-034-1712). NTIS, PC A02/MF A01.

An evaluation was made of occupational exposures to phenol, crystalline silica, total particulate, and fiber-glass particulates. General-room air samples for phenol showed levels to be 0.04 to 0.20 milligrams per cubic meter (mg/m^3). Cristobalite concentrations were below laboratory detection limits. Quartz levels, when detectable ranged from 0.05 to 0.06 mg/m^3. Total particulates were 0.07 to 0.59 mg/m^3. Fiberglass samples were below the detection limits. The respirator program in the electric arc furnace and in the foundry appeared to meet the OSHA requirements. The author concludes that a health hazard from exposures to quartz, cristobalite, total particulate, phenol and fiberglass did not exist at the time of the survey. It was recommended that compliance with the respiratory protection program be continued and that all workers be advised on all chemicals used in the foundry and the electric arc furnace, with particular concern given to their toxicity.

14282 **(PB—87-117040/XAB) Health hazard evaluation report HETA 86-341-1711, Miller Brands, Inc., Denver, Colorado.** Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 8p. (HETA—86-341-1711). NTIS, PC A02/MF A01.

The Operations Manager of Miller Brands Denver, Colorado, requested an evaluation of carbon monoxide (CO) exposures in the beer distributorship and storage facilities. Gasoline-powered beer trucks and fork lifts used inside large buildings generate the CO. The OSHA standard for CO is 50 parts per million (ppm) as a time-weighted average. CO measurements taken in the beer storage warehouse, in the beer-keg refrigerated storage room, and in the building where the filled trucks were within acceptable concentrations in all areas except the refrigerated keg storage room. Levels in the room reached 200ppm after the fork lift truck had been entering and exiting for about 20 minutes. The authors recommend that electric fork-lift trucks be used in the beer keg cool room to eliminate the CO hazard.

14283 **(PB—87-117057/XAB) Health-hazard evaluation report HETA 85-171-1710, International Bakers Services, Inc., South Bend, Indiana.** McConnell, R.S.; Hartle, R.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 41p. (HETA—85-171-1710). NTIS, PC A03/MF A01.

A health-hazard evaluation was conducted in the mixing room. In the mixing room, three employees weigh and load a large variety of fragrances, flavorings, starch, and 50- to 100-pound bags of flour into one of three mixers. Loading and mixing tasks generate considerable dust, previously measured to be 20 milligrams per cubic meter. Workers did not always use the respirator during clean up operations. Two workers with no known personal risk factors had developed castrophic fixed airways disease suggestive of bronchiolitis obliterans or emphysema. The authors conclude that the disease may have been caused by a single short-term exposure specific to a particular mix. The authors made recommendations. The report also contains the walk-through survey report made at the facility to study control technology employed in the manual transfer of chemical powders.

14284 **(PB—87-117511/XAB) Industry-wide studies report: a walk-through survey of R.T. French Company, Springfield, Missouri. Industry-wide study.** Stayner, L.; Greife, A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Aug 1986. 20p. (IWS—67.49). NTIS, PC A02/MF A01.

A walk-through survey was conducted to assess the feasibility of including workers from the facility in a NIOSH mortality and industrial hygiene study of workers exposed to ethylene oxide. Dry and wet food products such as mustard and spices are produced at the facility. ETO was first used at the facility in 1973 to reduce the microbial content of a variety of spices. About 77,250 pounds of ETO were used annually except in 1984 when about 36,000 was used. In 1984, the use of ETO was discontinued; raw materials are treated by an outside contractor. It was not possible to determine from personnel records which workers were potentially exposed to ETO. The author concluded that the facility should not be included in the larger ETO study because adequate personnel records or other records that can be used for identifying past and present workers exposed to ETO were not available.

14285 **(PB—87-117610/XAB) Industry-wide studies report: a walk-through survey of Travenol Laboratories, Incorporated, Cleveland, Mississippi.** Stayner, L.; Elliott, L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 8 Aug 1986. 17p. (IWS—67.51). NTIS, PC A02/MF A01.

A walk through survey was made to evaluate the facility for inclusion in an ongoing NIOSH mortality and industrial hygiene study of exposure of workers to ethylene oxide (EtO) during industrial sterilization processes. The facility manufactures disposable health-care products, many of which require sterilization with EtO as part of the process. Limited EtO exposure sampling data for distinct job titles exists for the facility. The authors conclude that the facility should be excluded from the larger study due to the inadequacy of the personnel records for identifying workers potentially exposed to EtO.

14286 **(PB—87-118519/XAB) Impact of ozone and sulfur dioxide on soybean yield.** Kress, L.W.; Miller, J.E.; Smith, H.J.; Rawlings, J.O. (Argonne National Lab., IL (USA)). 1986. 21p. NTIS, PC A02/MF A01.

Little dose-response information exists on the effects of chronic ozone (O_3) and intermittent sulfur dioxide (SO_2) exposures on the yield of important agricultural crops. Such information is needed for refinement of estimates of air pollution induced crop

losses. Field-grown plants of two soybean cultivars were exposed to incremental chronic doses of O_3 for 7-h/day and/or intermittent SO_2 fumigations 4-h/day, 3 day/wk from shortly after emergence until maturity. The O_3 was removed by charcoal filtration or applied by addition of various constant amounts of O_3 to the ambient O_3 present in nonfiltered-air open-top chambers. There were no cultivar differences in yield response to either O_3 or SO_2.

14287 **(PB—87-119053/XAB) Evaluation of asbestos abatement techniques. Phase 2. Encapsulation with latex paint. Final report, May 1984-November 1985.** Chesson, J.; Margeson, D.P.; Ogden, J.; Bauer, K.; Bergman, F.J. (Battelle Columbus Div., Washington, DC (USA)). Jul 1986. 110p. NTIS, PC A06/MF A01.

Airborne asbestos levels were measured by transmission electron microscopy (TEM) before, during and after encapsulation of asbestos-containing material with latex paint in a suburban junior high school. The ceilings of the school were covered with a sprayed-on material containing chrysotile asbestos. Air samples were collected at four types of sites: indoor sites with unpainted asbestos material scheduled for painting, indoor sites with asbestos material which had been painted 16 months prior to the study, indoor sites with no asbestos material, and outdoor sites on the roof of the building. Bulk samples were collected prior to painting and analyzed by polarized light microscopy (PLM) to characterize the asbestos-containing material.

14288 **(PB—87-120978/XAB) Asbestos in buildings: guidance for service and maintenance personnel.** Keyes, D.L. (Battelle Columbus Labs., Washington, DC (USA)). Jul 1985. 21p. NTIS, PC A02/MF A01.

See also Spanish version, PB87-120986, and PB86-116522.

The illustrated booklet was prepared by the United States Environmental Protection Agency to assist service and maintenance personnel in implementing special operating and maintenance procedures in buildings containing asbestos. The information is extracted from Guidance for Controlling Asbestos-Containing Materials in Buildings (EPA 560/5-85-024).

14289 **(PB—87-123162/XAB) Emissions test report air toxics sampling at Wyckoff, Inc., Bainbridge Island, Washington.** (Engineering-Science, Inc., Fairfax, VA (USA)). Mar 1986. 90p. NTIS, PC A05/MF A01.

The report discusses the results of sampling two vacuum exhausts and the fugitive emissions from two retorts at Wyckoff, Inc.'s creosote treating plant.

14290 **(PB—87-123212/XAB) Emissions test report: air-toxics sampling at Reichhold Chemical, Tacoma, Washington.** (Engineering-Science, Inc., Fairfax, VA (USA)). Mar 1986. 55p. NTIS, PC A04/MF A01.

From July 22 to August 2, 1985, ES sampled five sources at two plants in the Seattle, Washington area to collect data on emission of toxic compounds. The report discusses the results of sampling the discharge from an afterburner on a coating line.

14291 **(PB—87-129730/XAB) Ambient air/source transport and transformation relationships for selected hazardous air pollutants.** Brewer, R.L.; Gordon, R.J.; Lin, C.C.; Countess, R.J.; Peters, T.J. (Global Geochemistry Corp., Canoga Park, CA (USA)). Nov 1986. 309p. NTIS, PC A14/MF A01.

The study was undertaken with the goal of obtaining information that could improve modeling technique for hazardous organic vapors in the atmosphere. It was proposed that both source-receptor and dispersion models be applied. Detailed examination of alternative choices for pollutant-emission site and method of determination was made. The benzene class as pollutants, a waste disposal site near Taft, California (in the San Joaquin Valley) as source, and Tenax adsorption from the air, followed by thermal desorption and gas chromatography as method of determination, were selected. A combination of poor meteorological conditions, inadequate sample collection, and contribution from other unidentified organic source prevented the determination of suitable modeling determination. Conclusions and recommendation for future sampling studies are included.

14292 **(PB—87-141040/XAB) VOC (volatile organic compound emission factors for the NAPAP (National Acid Precipitation Assessment Program) emission inventory. Final report, August 1985-August 1986.** Stelling, J.H.; Bloomhardt, M.A.; McKenzie, I.M. (Radian Corp., Research Triangle Park, NC (USA)). Dec 1986. 172p. NTIS, PC A08/MF A01.

The report gives results of the generation of emission factors for volatile organic compound (VOC) emissions for a number of source classification categories (SCCs), as part of the National Acid Precipitation Assessment Program (NAPAP). Each SCC represents a process or function that is logically associated with a point source of air pollution within a given source category. The objective of this effort was to estimate VOC emission factors for categories where substantial amounts of VOC emissions would be expected. In addition to emission factors previously reported, the report includes emission factor estimates developed from a variety of readily available information. Data gathered during numerous standards-setting activities as well as data provided from state emissions inventory data bases were used to calculate the new emission factor estimates. Major emphasis of this effort was on organic chemical manufacturing processes and storage of petroleum products and organic chemicals.

14293 **(UCRL—15870) Research on the climatic effects of nuclear winter: Final report.** Dickinson, R.E. (Lawrence Livermore National Lab., CA (USA); National Center for Atmospheric Research, Boulder, CO (USA)). 3 Dec 1986. Contract AI03-84SF12208;W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004319.

The National Center for Atmospheric Research (NCAR) has undertaken a series of research efforts to develop and implement improvements to the Community Climate Model (CCM) needed to make the model more applicable to studies of the climatic effects of nuclear war. The development of the model improvements has reached a stage where implementation may proceed, and several of the developed routines are being incorporated into the next approved version of the CCM (CCM1). Formal documentation is being completed describing the specific model improvements that have been successfully implemented. This final report includes the series of annual proposals and progress reports that have guided the project.

14294 **(WMO—61) Report of the International Conference on the Assessment of the Role of Carbon Dioxide and of other Greenhouse Gases in Climate Variations and Associated Impacts.** (World Meteorological Organization, Geneva (Switzerland)). 1986. 83p. (ETN—86-97660; CONF-8510385—). NTIS MF A01; print copy available at WMO, Geneva, Switzerland.

From International conference on the assessment of the role of carbon dioxide and of other greenhouse gases in climate variations and associated impacts; Villach, Austria (9 Oct 1985).

The contributions to and environmental, social, and economic impact of the greenhouse effect were discussed. It was concluded that it is a matter of urgency to refine estimates of future climate conditions to improve planning decisions. Climate change and sea level rises due to greenhouse gases are closely linked with other major environmental issues, such as acid deposition and threats to the Earth's ozone shield, mostly due to changes in the composition of the atmosphere by man's activities. While warming of climate appears inevitable due to past actions, the rate and degree of future warming could be profoundly affected by governmental policies on energy conservation, use of fossil fuels, and the emission of greenhouse gases.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13910, 14185, 15233

14295 **(DOE/EV/10374—3-Final) The measurement of ^{222}Rn and its relationship to environmental variables: Factors controlling indoor radon: Final report for the contract period June 1, 1982 to May 31, 1985.** Harley, N.H. (New York Univ., NY (USA). Inst. of Environmental Medicine). 1985. Contract AC02-80EV10374. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004323.

Indoor levels of radon-222 and daughter nuclei were monitored at various locations within a single family dwelling and in an apartment building. Indoor levels were correlated with soil temperature, atmospheric pressure, wind, rain and time of year. 9 refs., 23 figs., 19 tabs.

14296 **(INIS-mf—10089) Radioactive discharges and monitoring of the environment. Annual report, 1984.** (British Nuclear Fuels Ltd., Risley). 1985. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86780524.

Information is given on the liquid, airborne, and solid radioactive discharges through authorized outlets, and on environmental monitoring for all of BNFL's works and sites for 1984; i.e., Sellafield site and Drigg storage and disposal site; Chapelcross works; Springfields works and Ulnes Walton disposal site; Capenhurst works. Included is assessment of radiation doses to representative members of the most highly exposed group of the general population for the most important environmental pathways.

14297 (INIS-mf—10100, pp 15) **Statistical evaluation of releses of C-14 from a Triga reactor.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14298 (INIS-mf—10101, pp 4) **Modelling indoor exposure to natural radioactive nuclides.** Hofmann, W.; Daschil, F. (Salzburg Univ., Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14299 **Distribution of airborne radon-222 concentrations in U.S. homes.** Nero, A.V.; Schwehr, M.B.; Nazaroff, W.W.; Revzan, K.L. (Lawrence Berkeley Lab., CA). *Science (Washington, D.C.);* No. 4779, 992-997(21 Nov 1986).

Apparently large exposures of the general public to the radioactive decay products of radon-222 present in indoor air have led to systematical appraisal of monitoring data from U.S. single-family homes; several ways of aggregating data were used that take into account differences in sample selection and season of measurements. The resulting distribution of annual-average radon-222 concentrations can be characterized by an arithmetic mean of 1.5 picocurie per liter (55 becquerels per cubic meter) and a long tail with 1 to 3% of homes exceeding 8 picocuries per liter, or by a geometric mean of 0.9 picocurie per liter and a geometric standard deviation of about 2.8. The standard deviation in the means is 15%, estimated from the number and variability of the available data sets, but the total uncertainty is larger because these data may not be representative. Available dose-response data suggest that an average of 1.5 picocuries per liter contributes about 0.3% lifetime risk of lung cancer and that, in the million homes with the highest concentrations, where annual exposures approximate or exceed those received by underground uranium miners, long-term occupants suffer an added lifetime risk of at least 2%, reaching extraordinary values at the highest concentrations observed.

5006 Regulations

REFER ALSO TO CITATION(S) 13091, 13092, 13093, 13451, 13732, 13733

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

14300 **(CONF-870201—3) Changes in aboveground biomass and nutrient content on Walker Branch Watershed from 1967 to 1983.** Johnson, D.W.; Henderson, G.S.; Harris, W.F. (Oak Ridge National Lab., TN (USA); Missouri Univ., Columbia (USA). School of Forestry, Fisheries and Wildlife; National Science Foundation, Washington, DC (USA)). 1987. Contract AC05-84OR21400. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004264.

From Central hardwood forest conference; Knoxville, TN, USA (24 Feb 1987).

The increment of forest biomass and nutrient content on Walker Branch Watershed, Tennessee, from 1967 to 1983 was interrupted by two insect outbreaks. An outbreak of the southern pine beetle in the early 1970s and an outbreak of the hickory borer in the late 1970s to early 1980s killed a number of shortleaf pine (Pinus echinata) and hickory (Carya spp.), respectively. Yellow-poplar (Liriodendron tulipifera) growth increased over this 16-year period, especially in response to the mortality of shortleaf pine. The net result of these events was little change in total biomass but a substantial shift in species composition (from pine to yellow-poplar) in the Pine forest type over this period. No species has yet responded to the mortality of hickory. Due to the shift in species composition in the Pine type, calcium and magnesium accumulation rates in biomass increased but foliage biomass decreased over the inventory period. There was little change in foliage biomass or nutrient content in other forest types, despite hickory mortality, since mortality occurred primarily among large trees having low foliage-to-woody-biomass ratios. The insect attacks, combined with apparently natural self-thinning, caused a large increase in standing dead biomass and in nutrient return via tree fall. This increased rate of return will substantially alter forest floor nutrient content and availability, especially with regard to calcium (where the calcium content of standing dead currently equals forest floor calcium content) and nitrogen (where inputs of woody litter will substantially alter carbon to nitrogen ratios). 23 refs., 7 figs., 2 tabs.

14301 **(EGG—10282-2131) Coyote visits at scent stations in relation to home range.** Harris, C.E.; Knowlton, F.F. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations; Utah State Univ., Logan (USA)). 1986. Contract AC08-83NV10282. 32p. NTIS, PC A03/MF A01. File Number DE87004426.

Response of free-franging coyotes (Canis latrans) to scent stations was studied in southeastern Idaho and southern Texas to examine relationships between the scent-station survey technique and coyote home range. Coyotes with radio transmitters were intensively monitored to determine movement and spatial use patterns for comparison with coyote visitations to artificial scent stations. Coyotes more frequently visited scent stations on the periphery or outside their home ranges than within them, probably because resident coyotes avoided scent stations (novel stimuli) in the very familiar core areas of their home ranges and were more likely to investigate them when encountered on the periphery or outside of them. Hence, scent stations may receive more visits from transient or dispersing individuals than from residents. 55 refs., 4 tabs.

14302 **(FWS/OBS—82/47.1) Northwestern Florida ecological characterization: An ecological atlas: Map narratives.** Palik, T.F.; Kunneke, J.T. (Martel Labs., Inc., St. Petersburg, FL (USA)). Sep 1984. 1939p. (MMS—85-0011). NTIS, PC A99/MF A01. File Number TI87900418.

This study provides an atlas of ecological resources along the Big Bend and Panhandle coastline of Florida. The study area comprises 18 coastal counties, an area of 30,460 square kilometers

(11,764 square miles). This atlas is designed to provide information and assist government and industry decisionmakers in coastal resource and environmental planning. In particular, results of this study will be utilized for the outer continental shelf oil and gas leasing program, in developing management plans for pipeline corridors, and onshore facilities planning. The production of this ecological atlas included four major tasks: the collection and synthesis of the latest available data on biological, socioeconomic, soil, oil and gas, hydrology, and climatological parameters; the assimilation of these data into a format which is compatible with the requirements of 1:100,000 scale mapping; the compilation of 90 ecological atlas maps; and the preparation of an atlas narrative serving to describe more fully the mapped parameters. This ecological atlas will embrace the habitat mapping study, the socioeconomic study, and the environmental synthesis being conducted for the study area.

14303 **(INIS-BR—564) Magnetometry, radiometry and gamma spectrometry of the Janjao diatreme, Lages, State of Santa Catarina, Brazil.** Svisero, D.P. (Sociedade Brasileira de Geologia, Sao Paulo). 1985. 12p. (In Portuguese). (CONF-8510375—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE87701292.

From 2. geology South Brazilian symposium; Florianopolis, Brazil (1 Oct 1985).

Magnetic, radiometric and gamma spectrometric surveys have been carried out on the Janjao diatreme which outcrops near Lajes in central-east Santa Catarina State, Brazil. The body is deeply weathered on the surface and its concentrates contain serpentinized olivine, phlogopote, pyroxenes, ilmenites, garnet and zircon. The interpretation of the magnetic anomaly revealed an irregular diatreme whose main dimensions are 50 x 190 meters. A vertical to subvertical dyke cuts the main diatreme. The radiometric anomaly as well as the potassium content helped to delineate the contacts between the diatreme and its country rocks (sandstones). Faults striking NNE controlled the emplacement of the Janjao diatreme as well as the intrusion of an alkaline dyke located near the diatreme.

14304 **(NP—7751253) Systematics of soils in the Federal Republic of Germany. Summary.** (Deutsche Bodenkundliche Gesellschaft, Goettingen (Germany, F.R.). Arbietskreis fuer Bodensystematik). 1985. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE87751253.

The classification of soil types is preceded by a detailed list of symbols and definitions referring to horizons. The symbols facilitate the characterisation of a soil profile. The soils discussed are terrestrial soils, semiterrestrial soils, semisubhydric and subhydric soils, moorlands and periglazial soils. Palaeosoils in the Federal Republic of Germany are mentioned.

14305 **Recent and historic red spruce mortality: evidence of climatic influence.** Johnson, A.H.; Friedland, A.J.; Dushoff, J.G. (Pennsylvania Univ., Philadelphia, USA). *Water, Air, and Soil Pollution;* **30**: No. 1-2, 319-330(Sep 1986). (CONF-850944—).

From Muskoka conference: international symposium on acidic precipitation; Toronto, Ontario, Canada (15 Sep 1985).

A period of declining growth and extensive mortality of red spruce (Picea rubens Sarg.) has been in progress for the past two decades in the montane forests of New York, Vermont and New Hampshire. Those areas are subject to particularly high levels of pollutant input and there is concern that airborne chemicals have destabilized the forest ecosystems. Field reports indicate that major episodes of mortality also occurred prior to the era of widespread industrial pollution, particularly in the 1870's and 1880's. The present and past periods of mortality have similarities as well as differences, and whether the primary causes are the same cannot be confidently determined with the information currently available. One similarity is that recent and past episodes of red spruce mortality tended to occur during or immediately after periods which are climatically unfavorable for this species. 40 refs.

14306 **Evapotranspiration and soil heterogeneity.** Luxmoore, R.J.; Sharma, M.L. (Oak Ridge National Lab., TN). *Agricultural Water Management;* **8**: 279-289(1984). Contract W-7405-ENG-26.

By using scaling theory, effects of soil spatial heterogeneity on evapotranspiration of a grassland catchment were simulated by the Terrestrial Ecosystem Hydrology Model (TEHM). Annual evapotranspiration was predicted to increased up to 22% for soils with smaller mean pore size (finer textured) than the reference silty loam soil. Analysis carried out to examine plant responses for soils of varying hydraulic properties suggested that water potential and stomatal conductance of foliage were generally higher for finer textured soils. This increased water supply to vegetation was related to higher water capacity of soils with smaller pore sizes in this instance. The analysis showed that spatial variation in soil hydraulic properties could significantly influence areal evapotranspiration. However, it must be appreciated that these simulation results are dependent on the soil-plant-weather combination. 10 references, 5 figures, 4 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 13190, 13305, 13306, 14243, 14355, 14356, 14357, 14367

14307 **(CONF-8510394—) 1st colloquium on humus of the German Society for Soil Science (DBG). Papers.** (Deutsche Bodenkundliche Gesellschaft, Goettingen (Germany, F.R.)). 1986. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE87751255.

From 1. colloquium on humus of the Deutsche Bodenkundliche Gesellschaft; Bayreuth, F.R. Germany (29 Oct 1985).

The 31 contributions discuss ecological aspects of and research projects on humic substances (e.g. IR-spectra, HPLC, IR spectrometry, CPMAS-13 C-NMR spectrometry of humic acids, herbicides, pephides, proteins, amino acids, xenobiotic substances, lignin).

14308 **(EPRI-EA—4740) Round-robin evaluation of regulatory extraction methods for solid wastes: Interim report.** Mason, B.J.; Carlile, D.W. (ETHURA, Grants Pass, OR (USA); Pacific Northwest Lab., Richland, WA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. Contract AC06-76RL01830;AC05-84OR21400. 190p. NTIS, PC A09/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1; GPO Dep. File Number DE87004106.

The reproducibility of the recently proposed Toxic Characteristic Leaching Procedure (TCLP) was evaluated in comparison to current extraction procedures. Three fly ash samples, two bottom ash samples and two flue gas desulfurization (FGD) sludges from coal fired power plants were compared using a split-plot design and a maximum likelihood estimation method. The main benefits of the TCLP appears to be that it provides better reproducibility of the extractions, in the ease of operation in the laboratory and in reduced costs for extractions of non-volatile components of the wastes. One of the major savings of time is in the reduced amount of time that the operator must observe the extraction. Due to impurities present in the glass fiber filters, the TCLP extracts can yield elevated concentrations of some elements. Corrections based upon procedural blanks could alleviate this bias in most cases.

14309 **(PB—87-101093/XAB) Impact of a clay cap on the migration of hazardous materials from a land-disposal site. Research report.** Smith, J.W.; Fry, T.S. (Tennessee Univ., Knoxville (USA). Water Resources Research Center). Feb 1986. 75p. (RR—109). NTIS, PC A04/MF A01.

The closure of a land-disposal operation imparts different signals to different parties depending on their interest in the site. The placement of a clay cap on the Hardeman County landfill has had questionable effect on the movement of materials from the disposal site. Analysis of monitoring data indicates a general trend of continual movement of pollutants down gradient from the fill area. The limited data base does not allow definitive conclusions to be drawn relative to the effectiveness of the clay cap in reducing or halting the movement of leachate from the disposal site. The at-

tempted simulation technique conceptualizes the movement of the leachate with time.

14310 **(PB—87-112306/XAB) Systems to accelerate in situ stabilization of waste deposits.** Amdurer, M.; Fellman, R.T.; Roetzer, J.; Russ, C. (Envirosphere Co., New York (USA)). Sep 1986. 305p. NTIS, PC A14/MF A01.

In-situ systems to accelerate the stabilization of waste deposits involve three essential elements: selection of a chemical or biological agent (reactant) that can react with and stabilize the waste, a method for delivery of the reactant to the deposit, and a method for recovery of the reaction products or mobilized waste. Four reactant categories were examined: biodegradation, surfactant-assistant flushing, hydrolysis, and oxidation. Of these, biodegradation and surfactant-assisted flushing appear most promising as in-situ treatment techniques. Methods of delivery of reactants based upon gravity include surface flooding, ponding, surface spraying, ditching, and subsurface infiltration beds and galleries. Forced injection (pumping) may also be used. Permeability is an important consideration in selecting the delivery system. Recovery systems using gravity include open ditching and buried drains, and pumped methods include wellpoint and deep well systems. Basically, the same limitations that apply to delivery systems are also true for recovery systems.

14311 **(PB—87-115796/XAB) Solubility of 2,3,7,8-TCDD (tetrachlorodibenzo-p-dioxin) in contaminated soils.** Jackson, D.R.; Roulier, M.H.; Grotta, H.M.; Rust, S.W.; Warner, J.S. (Battelle Columbus Div., OH (USA)). 1986. 18p. NTIS, PC A02/MF A01.

Soils from ten sites contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) were investigated in aqueous batch and intact core leaching studies to determine water/soil partition coefficients (K/sub p/) for TCDD and factors affecting the K/sub p/. TCDD content in soils ranged from 8 to 26,000 ng/g. For the batch extractions, TCDD concentrations in solution ranged from 0.1 to 56 ng/L; 79% of the values were 2.0 ng/L or less. For the intact cores, TCDD concentrations in leachate ranged from 0.1 to 14 ng/L; 81% of the values were 2.0 ng/L or less. The amount of TCDD in the soil and the amount of TCDD in the water extracts were strongly related to the total solvent-extractable organic matter (SEOM) in soil and the halogenated semi-volatiles in the solvent-extractable fraction. These results suggest that co-contaminants in the wastes along with the TCDD were sorbed to the soil and that these materials as a group greatly influence the partitioning of TCDD between soil and water in these contaminated soils.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13304, 13305, 13306, 14296

14312 (INIS-mf—10100, pp 14) **Evaluation of an anomalous local tritium fallout by analysis of tree rings.** Kozak, K.; Biro, T.; Golder, F.; Rajner, V.; Rank, D.; Staudner, F. (Institute of Isotopes, Budapest, Hungary; Bundesversuchs- und Forschungsanstalt Arsenal, Vienna, Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14313 (INIS-mf—10100, pp 60) **Transport of radionuclide through the soil.** Knezevic, L.; Vukovic, Z. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14314 (INIS-mf—10100, pp 11) **Example for the use of advanced computers in environmental networks: the on-line dose rate measuring network around nuclear power plants in Baden-Wuerttemberg.** Maushart, R. (Laboratorium Prof. Dr. Berthold, Wildbad, Germany). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14315 (INIS-mf—10100, pp 12) **Computer controlled area surveillance system for the Triga Mark II Reactor, Vienna.** Hammer, J.; Boeck, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14316 (INIS-mf—10100, pp 13) **Data processing in the authorized environmental radiation protection system of the nuclear plant, Paks.** Kanyar, B.; Laczai, J.; Szabo, Z.; Sztanyik, L.B. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14317 (INIS-mf—10100, pp 16) **Dose level measurements during startup of the second unit of the Paks nuclear power plant.** Feher, S.; Nagy, M.F.; Viragh, E.; Ronaky, J.; Rosa, G. (Techn. Univ. Budapest, Hungary; Paks N.P.P., Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14318 (INIS-mf—10100, pp 27) **Measurements of fast neutron spectrum and transmission of fast neutrons.** Nikolic, D.; Milosevic, M.; Pesic, M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14319 (INIS-mf—10100, pp 18) **Microcomputer for the user-oriented display of radiation monitoring data at the Paks Nuclear Power Station.** Ronaky, J.; Katics, B.; Kovacs, B.; Fodor, Z. (Paks Nuclear Power Station, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14320 (INIS-mf—10100, pp 19) **Improvement of the telemetric and data acquisition system for environmental monitoring at Paks.** Deme, S.; Feher, I.; Roevid, M.; Takacs, P. (Hungarian Academy of Sciences, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14321 **(INIS-mf—10101) Report of the expert committee on the review of data on atmospheric fallout arising from British nuclear tests in Australia.** (International Atomic Energy Agency, Vienna (Austria)). 31 May 1984. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780532.

The terms of reference of the committee were to review the published scientific literature and other relevant scientific data on the short and long-term effects of fallout arising from British nuclear tests in Australia; to comment on the adequacy of the data available and the collection methodology; to assess the fallout levels arising from each of the tests, the immediate and subsequent hazards from the fallout to the Australian population and individual Australians, including Australian personnel involved and aborigines in South Australia, and the adequacy of the criteria for safe firing of each of the tests. A comparison is made of radiation protection standards adopted during the nuclear test period with current

standards. The recommendations include the setting up of a public inquiry to determine how the conduct and consequences of the British nuclear tests affected the health and well-being of Australians.

14322 **(NIRS-RSD—61) Radioactivity survey data in Japan.** (Japan Chemical Analysis Center, Chiba). Jun 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

Items within the scope of EDB have been entered individually into the data base. (ACR)

14323 (NIRS-RSD—61, pp 5-6) **Strontium-90 and cesium-137 in total diet (from October 1981 to July 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in total diet (from October 1981 to July 1982) were determined. A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet" from 26 sampling locations. The results are shown in a table.

14324 (NIRS-RSD—61, pp 7) **Strontium-90 and cesium-137 in rice (producing districts). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rice (producing districts in December 1981) were determined. Polished rice was collected from two producing districts at the harvest. The results are shown in a table.

14325 (NIRS-RSD—61, pp 8-9) **Strontium-90 and cesium-137 in rice (consuming districts) (from October 1981 to January 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rice (consuming districts from October 1981 to January 1982) were determined. Polished rice was collected from ten consuming areas when new crops were first put on sale. The results are shown in a table.

14326 (NIRS-RSD—61, pp 10-11) **Strontium-90 and cesium-137 in milk (producing districts for WHO program) (from November 1981 to June 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (producing districts for WHO program from November 1981 to June 1982) were determined. Raw milk was collected in 11 producing districts. The results are shown in a table.

14327 (NIRS-RSD—61, pp 12) **Strontium-90 and cesium-137 in milk (producing districts for domestic program) (from October 1981 to February 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (producing districts for domestic program from October 1981 to February 1982) were determined. Raw milk was collected in five producing districts. The results are shown in a table.

14328 (NIRS-RSD—61, pp 13-14) **Strontium-90 and cesium-137 in milk (consuming districts) (from August 1981 to May 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (consuming districts from August to May 1982) were determined. Commercial milk was purchased in 26 consuming districts. The results are shown in a table.

14329 (NIRS-RSD—61, pp 15) **Strontium-90 and cesium-137 in milk (powdered milk). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in powdered milk (May 1982) were determined. Four brands of commercial powdered milk were purchased in consuming districts as samples. The results are shown in a table.

14330 (NIRS-RSD—61, pp 15-17) **Strontium-90 and cesium-137 in vegetables (producing districts) (from October 1981 to March 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in vegetables (producing districts from October 1981 to March 1982) were determined. Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively, from 11 sampling locations. The results are shown in a table.

14331 (NIRS-RSD—61, pp 18-19) **Strontium-90 and cesium-137 in vegetables (consuming districts) (from November 1981 to January 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in vegetables (consuming districts from November 1981 to January 1982) were determined. Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively, from six sampling locations. The results are shown in a table.

14332 **(NIRS-RSD—63) Radioactivity survey data in Japan.** (Japan Chemical Analysis Center, Chiba). Dec 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

Items within the scope of EDB have been entered individually into the data base. (ACR)

14333 (NIRS-RSD—63, pp 5-6) **Strontium-90 and cesium-137 in total diet (from June 1982 to December 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in total diet (from June to December 1982) were determined. A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet" from 22 sampling locations. The results are shown in a table.

14334 (NIRS-RSD—63, pp 7) **Strontium-90 and cesium-137 in rice (producing districts) (from October 1982 to December 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rice (producing districts from October to December 1982) were determined. Polished rice was collected from six producing districts at the harvest. The results are shown in a table.

14335 (NIRS-RSD—63, pp 8-9) **Strontium-90 and cesium-137 in rice (consuming districts) (from September 1982 to December 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in rice (consuming districts from September to December 1982) were determined. Polished rice was collected in 18 consuming areas when new crops were first put on sale. The results are shown in a table.

14336 (NIRS-RSD—63, pp 10-11) **Strontium-90 and cesium-137 in milk (producing districts for WHO program) (from April 1982 to December 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (producing districts for WHO program from April to December 1982) were determined. Raw milk was collected in ten producing districts. The results are shown in a table.

14337 (NIRS-RSD—63, pp 12) **Strontium-90 and cesium-137 in milk (producing districts for domestic program) (from June 1982 to August 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (producing districts for domestic program from June to August 1982) were determined. Raw milk was collected in six producing districts. The results are shown in a table.

14338 (NIRS-RSD—63, pp 13-14) **Strontium-90 and cesium-137 in milk (consuming districts) (from May 1982 to August 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in milk (consuming districts from May to August 1982) were determined. Commercial milk was purchased in 20 consuming districts. The results are shown in a table.

14339 (NIRS-RSD—63, pp 15) **Strontium-90 and cesium-137 in milk (powdered milk). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in powdered milk (October 1982) were determined. Four brands of commercial powdered milk were purchased in consuming districts as samples. The results are shown in a table.

14340 (NIRS-RSD—63, pp 16-18) **Strontium-90 and cesium-137 in vegetables (producing districts) (from May 1982 to July 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in vegetables (producing districts from May to July 1982) were determined. Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively, from 12 sampling locations. The results are shown in a table.

14341 (NIRS-RSD—63, pp 21) **Strontium-90 and cesium-137 in tea (Japanese tea). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in tea (Japanese tea) were determined. Five hundred grams of manufactured green tea was collected from six sampling locations in Japan. The results are shown in a table.

5105 Site Resource And Use Studies

14342 **(EGG—10282-2125) Summary and evaluation of the coyote control program, Naval Petroleum Reserve No. 1, Kern County, California, 1986.** Scrivner, J.H.; Harris, C.E. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Nov 1986. Contract AC08-83NV10282. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004457.

For the second consecutive year (1986) the US Department of Energy funded a coyote (Canis latrans) control program in an attempt to reduce predation of the endangered San Joaquin kit fox (Vulpes macrotis mutica) on Naval Petroleum Reserve No. 1 in Kern County, California. A total of 46 adult and 18 pups were taken. Trapping was the most productive control method. Data were gathered on standard measurements, weights, ages, and reproductive condition of the coyotes. No kit foxes were trapped. Recommendations were made to begin the 1986/1987 control program in December 1986, and to use helicopters for aerial gunning and to locate coyote dens.

5106 Regulations

14343 **(DOE/HWP—22) Hazardous process material substitution.** Evans, D.R.; Nishimoto, D.D.; Sanders, R.D. Sr. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1987. Contract AC07-76ID01570;AC05-84OR21400. 28p. NTIS, PC A03/MF A01. File Number DE87004164.

The Hazardous Process Material Substitution project, initiated in February 1986, and scheduled through FY 1990, was terminated at the end of FY 1986. This report summarizes the results of an eight-month study conducted during FY 1986 in which material substitutions and, to a lesser extent, process modifications, were evaluated as means to minimize HW and RMW generation. The conclusions presented here, though based on the best available current information, must be viewed as preliminary in the absence of the evaluation studies that were planned for future years. Moreover, the unavailability of updated information from the DOE Waste Information Network (WIN) data base precluded evaluation of applicable waste streams from other DOE sites, as was originally intended.

14344 **(INIS-mf—10120) Act No. 85.661 of 3 July 1985 amending and supplementing Act No. 76-663 of 19 July 1976 on installations classified for purposes of environmental protection.** (International Atomic Energy Agency, Vienna (Austria)). 4 Jul 1985. 2p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE87780058.

The amendments made by this Act introduce new provisions in the 1976 Act to increase the penalties prescribed in cases where classified installations are operated in illegal conditions. In particular, increased fines and terms of imprisonment are laid down for operating an installation without a licence. (NEA).

14345 **(PB—87-101606/XAB) Background document for the ground-water screening procedure to support 40 CFR Part 268 - land-disposal restrictions (includes appendixes a-g).** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste). Jan 1986. 342p. (EPA—530/SW-86/047). NTIS, PC A15/MF A01.

The procedure provides information on the model developed by the Office of Solid Waste to determine maximum acceptable concentrations for hazardous constituents in extracts of wastes. The ground-water screening procedure involves a back calculation from a point of potential exposure at a distance downgradient from a land-disposal unit to a point of release from the unit using a fate and transport model.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 13146, 13147, 14302, 14368

14346 **(NP—7900410) Tampa Bay environmental atlas.** Kunneke, J.T.; Palik, T.F. (Martel Labs., Inc., St. Petersburg, FL (USA)). Dec 1984. 551p. US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458. File Number TI87900410.

Biological and water resource data for Tampa Bay were compiled and mapped at a scale of 1:24,000. This atlas consists of (1) composited information overlain on 18 biological and 20 water resource base maps and (2) an accompanying map narrative. Sub-

jects mapped on the water resource maps are contours of the mean middepth specific conductivity which can be converted to salinity; bathymetry, sediments, tidal currents, the freshwater/saltwater interface, dredge spoil disposal sites; locations of industrial and municipal point source discharges, tide stations, and water quality sampling stations. The point source discharge locations show permitted capacity and the water quality sampling stations show 5-year averages for chlorophyll, conductivity, turbidity, temperature, and total nitrogen. The subjects shown on the biological resource maps are clam and oyster beds, shellfish harvest areas, colonial bird nesting sites, manatee habitat, seagrass beds and artificial reefs. Spawning seasons, nursery habitats, and adult habitats are identified for major fish species. The atlas will provide useful information for coastal planning and management in Tampa Bay.

14347 **(NP—7900465) The ecology of Lake St. Clair wetlands: A community profile.** Herdendorf, C.E.; Raphael, C.N.; Jaworski, E. (Ohio State Univ., Columbus (USA). Center for Lake Erie Area Research; Eastern Michigan Univ., Ypsilanti (USA). Dept. of Geography and Geology). Sep 1986. 202p. US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458. File Number TI87900465.

This publication reviews the ecological data and information on the wetlands of Lake St. Clair. The lake, which is a part of the Great Lakes ecosystem, is situated between southeastern Michigan and southwestern Ontario. Lake St. Clair contains a substantial portion of the remaining Great Lakes coastal wetlands, with extensive wetlands occurring in the vicinity of the St. Clair River Delta. These wetlands are among the most productive areas in the Great Lakes ecosystem. This population summarizes the geologic history of the region leading to the development of wetlands and the present environment; biological production and community organization in the Lake St. Clair wetlands are also examined. The publication closes with a chapter on applied ecology which addresses issues such as wetland disturbance, management, and future prospects for these wetlands.

14348 **(NP—7900466) The ecology of pools 19 and 20, upper Mississippi River: A community profile.** Jahn, L.A.; Anderson, R.V. (Western Illinois Univ., Macomb (USA). Dept. of Biological Sciences). Sep 1986. 155p. US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. File Number TI87900466.

To accommodate navigation, the Upper Mississippi River has been extensively modified by the dredging of navigation channels and the construction of a series of lock and dam structures. Each lock and dam creates a pool in the river. This document reviews ecological information and data on navigation pools 19 and 20 of the Upper Mississippi River extending from near Keokuk, IA, southward to Canton, MO, and Meyer, IL. This report reviews the geologic history and present physiographic conditions of the pools. Biological populations inhabiting or associated with the pools are described, followed by a section on community functions which includes a discussion of production and trophic interactions. The final chapter describes human impacts on this section of the river.

14349 **(NP—7900467) The ecology of pools 11-13 of the upper Mississippi River: A community profile.** Eckblad, J.W. (Luther Coll, Decorah, IA (USA). Dept. of Biology). Dec 1986. 99p. US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. File Number TI87900467.

The once free flowing Upper Mississippi River has now been extensively modified into a series of pools by the installation of a series of dams and navigation locks intended to accommodate shipping. Each dam creates a pool in the river and serves to maintain water depths sufficient for the passage of commercial barges. This publication reviews the ecological information available for Navigation Pools 11 through 13 of the Upper Mississippi River, an area extending from above Prairie du Chien, Wisconsin, to near Clinton, Iowa. This report reviews the geologic history and present physiography of the area. Biological populations inhabiting or associated with the pools are described and the ecological interactions are discussed. The final chapter describes human impacts on the Pool 11 to 13 reach of the river and reviews management options designed to minimize these impacts.

14350 **(PB—87-115945/XAB) Beaufort Sea monitoring program: analysis of trace metals and hydrocarbons from Outer Continental Shelf (OCS) activities. Final report, 1983-1986.** Boehm, P.D.; Crecelius, E.; Steinhauer, W.; Steinhauer, M.; Tuckfield, C. (Battelle New England Marine Research Lab., Duxbury, MA (USA)). 13 Aug 1986. 260p. NTIS, PC A12/MF A01.

An environmental-monitoring program, designed to detect and quantify long-term changes in sediment and tissue concentrations of metals and hydrocarbons potentially due to oil and gas exploration and development on the U.S. Beaufort Sea continental shelf, was initiated in 1984. In Year-1 of the three-year study, a series of benthic stations was established in the nearshore area between Barter Island and Cape Halkett. In Year-2 of the study, areal coverage of the Study Area was increased to 39 marine stations and 10 shoreline and river stations. Analysis of six replicate sediment samples for trace metals, and saturated and aromatic hydrocarbons revealed a wide range of concentrations. Both trace metal and hydrocarbon analyses of bivalve and crustacean tissues indicated concentrations differences between species but no apparent relationship between animal body burdens and sediment concentrations.

14351 **(PB—87-131231/XAB) Contaminant levels and relative sensitivities to contamination in the deep-ocean communities. Technical memo.** Grassle, J.F.; Caswell, H.; Farrington, J.W.; Stegeman, J.J.; Grassle, J.P. (National Ocean Service, Rockville, MD (USA). Office of Oceanography and Marine Assessment). Mar 1986. 262p. (NOAA/TM/NOS/OMA—26). NTIS, PC A12/MF A01.

Contents include: Analysis of existing information on susceptibility of deep-sea animals; Identification of population and community parameters determining relative sensitivity; Body burdens of contaminants; Body burdens of contaminants in deep-ocean communities.

14352 **Production ecology of invertebrates in small experimental ponds.** Cushman, R.M.; Franco, P.J.; Goyert, J.C.; Lesslie, P.A. (Oak Ridge National Lab., TN). *Journal of the Tennessee Academy of Science;* **61**: No. 3, 80-84(Jul 1986). Contract AC05-84OR21400.

Production of invertebrates is estimated for a series of small experimental ponds in Tennessee. Annual dry weight production of predator insects is about 4.5 g/m^2 and of herbivore-detritivore insects about 3.8 g/m^2; insects whose trophic position could not be classified account for an annual dry weight production of about 0.3 g/m^2. Annual dry weight production of zooplankton is about 14.5 t/m^2, of annelids 25.4 g/m^2 and of snails 3.1 g/m^2. The data are consistent with published information that the predator insects probably depend on a variety of energy sources to support their estimated production rate.

14353 **Relation between biomass and body weight of plankton in a steady state oceanic ecosystem.** Rodriguez, J.; Mullin, M.M. (Univ. of California, San Diego, La Jolla). *Limnology and Oceanography;* **31**: No. 2, 361-370(Mar 1986). Contract AS03-82ER60031.

In the size range from 10^{-4} to 10^{3} μg (carbon) body weight, the biomass of plankton in the euphotic layer of the North Pacific Central Gyre decreases as an allometric function of body weight. Even in a steady state ecosystem such as that analyzed here, there is variability in space and time; this suggests that one must be careful in extrapolating the relation to less predictable marine areas. In obtaining dynamic information from biomass spectra, one must distinguish changes due to the flow of energy within the spectrum (growth, predation, reproduction) from changes due to emigration from or immigration into the spectrum of the particular area sampled, such as those due to the diel vertical migration of macrozooplankton in the largest size classes.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 13182, 13185, 13186, 13230, 13275, 13305, 13852, 13957, 14248, 14253, 14308, 14309, 14311, 14351, 14384

14354 (AD-A—172655/3/XAB) Evaluation of the Sarex (trade name) 5-gpm oil-water separator, Type B. Final report. Musa, G.D. (Army Belvoir Research Development and Engineering Center, Fort Belvoir, VA (USA)). Jun 1986. 28p. (BRDEC—2435). NTIS, PC A03/MF A01.

This report covers an investigation conducted to evaluate the operational effectiveness of the Sarex 5 GPM Oil-Water Separator, Type B. The results of this study indicate that the Sarex 5 GPM Oil-Water Separator, Type B, is an effective method for the removal of crude oil from feedwater. The Sarex 5 GPM Oil-Water Separator Type B, could be operated under field conditions. An efficient and effective oil-water separator device is imperative in certain areas of the world where crude-oil contaminated feedwater is found. The presence of crude oil in the feedwater adversely affects the performance of the reverse osmosis water-purification units (ROWPUs) used by the Army and Marines to purify fresh, brackish, and salt water. Both the 600 GPH ROWPU and the 150,000 GPD ROWPU use multi-media and cartridge filters for the removal of suspended solids from the feedwater before they enter the reverse-osmosis membranes. Removal of the crude oil, which affixes to the filters, is accomplished by a laborious cleaning process or by replacement of the filters. Crude oil or a derived soluble oil passing the filters and entering the reverse osmosis elements would result in decreased production rate, degradation of the membrane elements, and decreased quality of product water. Thus, satisfactory operation of the ROWPU in this scenario is dependent upon an efficient and effective oil-water separator device.

14355 (AD-A—173737/8/XAB) Installation restoration program phase II - confirmation/quantification. Stage 1. Davis-Monthan Air Force Base, Arizona. Final report, January 1983-November 1984. (Dames and Moore, Park Ridge, IL (USA)). 18 Aug 1986. 307p. NTIS, PC A14/MF A01.

Investigated were 11 sites consisting of (1) the installation and sampling of two ground water monitor wells, (2) ground water sampling of eight base wells, and (3) drilling and sampling soils from 47 borings. The ground water and soil samples were analyzed for up to 54 constituents, including purgeable halocarbons and aromatics, pesticides, heavy metals, oil and grease, phenol, TOC, and PCBs. Measurable amounts of contamination in the soil may have been found at all sites. Sites 3, 18 and 1 appear to be the most contaminated.

14356 (AD-A—174095/0/XAB) Installation-restoration program. Phase 2 confirmation/quantification. Stage 1 for Carswell AFB, Texas. Volume 3. Appendices b-l. Final report. (Radian Corp., Austin, TX (USA)). Oct 1986. 362p. NTIS, PC A16/MF A01.

This purpose of this task is to undertake a field survey at Carswell AFB TX to determine: (1) the presence or absence of contamination within the specified areas of the survey; (2) the potential for migration of identified contaminants in the various environmental media; (3) additional investigations necessary to define the magnitude, extent, direction, and rate of migration of identified contaminants; and (4) potential environmental consequences and health risks of migrating contaminants.

14357 (AD-A—174349/1/XAB) Sanitary-landfill leachate recycle and environmental problems at selected Army landfills: lessons learned. Final report. Maloney, S.W. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Sep 1986. 45p. (CERL-TR-N—86/17). NTIS, PC A03/MF A01.

This report provides information on experience with leachate recycling - a method of treating leachate from landfills that removes various leachate components. Advantages of leachate recycling are its ability to increase the rate of stabilization of biodegradable organic matter and its potential to remove some heavy metals and organics from the leachate. Its major disadvantage is its potential to contribute to surface- or ground-water pollution under certain conditions. Installations considering use of leachate recycling should incorporate appropriate modifications into the landfill design and must select the landfill site carefully. They should also be aware of lessons learned from problem situations at other Army installations, and carefully coordinate planning with all appropriate regulating authorities. They should also use the technical expertise available from other Army agencies to assist with developing plans for the recycling option.

14358 (DOE/ER/60435—T1) Trace element geochemistry of the South Atlantic Bight: Progress report. Windom, H.L. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). Dec 1986. Contract FG09-86ER60435. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004081.

This report summarizes work on: (1) nearshore sediment stratigraphy, mineralogy and geochemistry; (2) Savannah River estuary; (3) preliminary studies for Fall Removal Experiment (FLEX); and (4) completion of SPREX data interpretation.

14359 (DOE/ER/60451—1) Production and turnover of suspended organic detritus in the coastal water of the southeastern continental shelf: Progress report, June 1, 1986 to May 31, 1987. Pomeroy, L.R. (Georgia Univ., Athens (USA). Inst. of Ecology). 1 Dec 1986. Contract FG09-86ER60451. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003988.

We are investigating the physics, chemistry and biology of the southeastern continental shelf, so energy-related impacts may be predicted or evaluated. While the study of water movement is basic to understanding the movement of water-borne pollutants, pollutants are frequently associated with particles. However, the transport and transformation of pollutants is strongly influenced by biological processes which create and destroy organic particles. The goals of this project are to understand and describe the biological processes which influence particle distribution and transport and their relation to physical transport processes. We have described the effects of water movements on the ecological processes on the shelf in terms of bacterial numbers, chlorophyll content, and other parameters of biomass and activity. We have sampled both the nearshore region of water of reduced salinity, influenced by river discharge, and the outer continental shelf, which is strongly influenced by the Gulf Stream. We are currently engaged in evaluating the interaction of these two systems, their effects on water movement on the continental shelf, and the biological consequences.

14360 (DOE/EV/02185—T2) Transport and transfer rates in the waters of the continental shelf and slope: SEEP-1 [Shelf Edge Exchange Processes]: Triennial report. Biscaye, P.E. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Dec 1986. Contract AC02-76EV02185. 187p. (COO—2185-16). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87003985.

The objective was to understand the fate of fine-grained particulate matter which acts as a carrier of pollutants of concern to DOE, particulate matter formed and suspended in the waters of the continental shelf in abundance, but largely lacking in the underlying sediments. It was hypothesized that a number of exchange and transport processes remove these particulates - both biogenic and non-biogenic - to the waters and sediments of the adjacent continental slope. The rates and mechanisms by which this transfer takes place were studied so as to be able, ultimately, to construct predictive models of the dispersion and removal of particle-reactive substances away from the coastal continental margins.

14361 (DOE/PC/80541—T5) A study of some wastewater contaminants: Fifth quarterly report for the period September 16, 1986 through December 15, 1986. Wilson, R.F. (Texas Southern Univ., Houston (USA). Dept. of Chemistry). 1986. Contract FG22-85PC80541. 10p. NTIS, PC A02. File Number DE87004247.

A composite model compound (2-Hydroxymethyl-6(2'- hydroxymethyl-5'-hydroxy- 4'pyrone-6')pyranyl- [3,2-b]pyran- 4,8-dione) was studied as a phenol-like substance to gain knowledge applicable to the study of phenols obtained from process wastewater contaminants. The interaction of iron(III) and copper(II) with our model reagent has been studied in some detail. The formation con-

stants and coordination numbers have been determined polarographically. Tabular and graphic data are presented.

14362 **(DP-MS—86-176) Inland wetland change detection using aircraft MSS [multispectral scanner] data.** Jensen, J.R.; Ramsey, E.W.; Mackey, H.E. Jr.; Sharitz, R.R.; Christensen, E.J. (South Carolina Univ., Columbia (USA). Dept. of Geography; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; EG and G Energy Measurements, Inc., Las Vegas, NV (USA)). 1986. Contract AC09-76SR00001. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004184.

Nontidal wetlands in a portion of the Savannah River swamp forest affected by reactor cooling water discharges were mapped using March 31, 1981 and April 29, 1985 high-resolution aircraft multispectral scanner (MSS) data. Due to the inherent distortion in the aircraft MSS data and the complex spectral characteristics of the wetland vegetation, it was necessary to implement multiple techniques in the registration and classification of the MSS imagery of the Pen Branch Delta on each date. In particular, it was necessary to use a piecewise-linear registration process over relatively small regions to perform image-to-image registration. When performing unsupervised classification, an iterative "cluster busting" technique was used, which simplified the cluster labeling process. These procedures allowed important wetland vegetation categories to be identified on each date. The multiple-date classification maps were then evaluated using a post-classification comparison technique yielding change classes that were of value in determining the extent of inland wetland change in this region.

14363 **(NP—7751259) 42. Report of the Study-Group of Rhine Water Works e.V., January-December 1985.** (Arbeitsgemeinschaft Rhein-Wasserwerke e.V., Duesseldorf (Germany, F.R.)). 1986. 158p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE87751259.

The year 1985 was characterized by the unusually long period of low water levels in autumn. During that time the flow of water fell for several weeks to under 1,000 m/sup 3//s even on the Lower Rhine. In consequence of the slight flow of water, the neutral salt load went up sharply. Concentrations of organic chlorine compounds also rose during that period. Thanks to the low flow of water it was possible to carry through investigations into the efficacy of filtration by the river banks and on the influence of the flow of water on the condition of the river bank filtrate. The results in the year under report show clearly that the improvement in the condition of the Rhine water observed in recent years has substantially increased the safety margin for all Rhine water works; in this the filtering effect of river banks and associated processes play a decisive part.

14364 **(PB—87-110375/XAB) Characteristics of lakes in the eastern united states.** (Environmental Protection Agency, Washington, DC (USA). Office of Acid Deposition, Environmental Monitoring, and Quality Assurance). Jun 1986. 1028p. NTIS, PC PC E99.

14365 **(PB—87-110383/XAB) Characteristics of lakes in the eastern United States. Volume 1. Population descriptions and physico-chemical relationships.** Linthurst, R.A.; Landers, D.H.; Eilers, J.M.; Brakke, D.F.; Overton, W.S. (Environmental Protection Agency, Washington, DC (USA). Office of Acid Deposition, Environmental Monitoring, and Quality Assurance). Jun 1986. 171p. (EPA—600/4-86/007A). NTIS, PC A08/MF A01.

A water sample was collected from each of 1612 lakes. This subset of lakes was selected from within three regions of the eastern U.S. (the Northeast, Upper Midwest, and Southeast) expected to exhibit low buffering capacity. Each region was divided in subregions. Subregions were further stratified by alkalinity map class. A suite of chemical variables and physical attributes thought to influence or be influenced by surface-water acidification was measured for each lake. The results of these measurements and data analyses are described in the report.

14366 **(PB—87-110391/XAB) Characteristics of lakes in the eastern United States. Volume 2. Lakes sampled and descriptive statistics for physical and chemical variables.** Overton, W.S.; Kanciruk, P.; Hook, L.A.; Eilers, J.M.; Landers, D.H. (Environmental Protection Agency, Washington, DC (USA). Office of Acid Deposition, Environmental Monitoring, and Quality Assurance). Jun 1986. 402p. (EPA—600/4-86/007B). NTIS, PC A18/MF A01.

A water sample was collected from each of 1612 lakes. This subset of lakes was selected from within three regions of the eastern U.S. (the Northeast, Upper Midwest, and Southeast) expected to exhibit low buffering capacity. Each region was divided in subregions. Subregions were further stratified by alkalinity map class. A suite of chemical variables and physical attributes thought to influence or be influenced by surface-water acidification was measured for each lake. The results of these measurements and data analyses are described in the report.

14367 **(PB—87-110664/XAB) Guidance document for cleanup of surface-impoundment sites.** (Camp Dresser and McKee, Inc., Boston, MA (USA)). Jun 1986. 46p. NTIS, PC A03/MF A01.

The guidance document addresses remedial actions for the cleanup of surface impoundments (defined as a pit, pond, and/or lagoon) containing hazardous wastes. Guidance is provided for the scoping and performance of a limited remedial investigation (limited RI) and limited feasibility study (limited FS). The guidance manual is to be used as an aid to State and Federal staff and private firms for the implementation of a remedial action for the cleanup of hazardous wastes contained in surface impoundments. The manual is informative rather than prescriptive in nature. The basic objectives are to provide a concise description of the necessary steps to implement surface remedial actions for the cleanup of surface impoundments within the provisions of the National Contingency Plan (NCP). It must be emphasized that this guidance is not to be used as an absolute reference. Its use should be supplemented with other EPA guidance documents and technical reports/references as appropriate.

14368 **(PB—87-116372/XAB) Acid deposition and watershed characteristics in relation to lake chemistry in northeastern Minnesota.** Rapp, G.; Allert, J.D.; Liukkonen, B.W.; Loucks, O.L.; Glass, G.E. (Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.). 1985. 18p. (EPA—600/J-85/448). NTIS, PC A02/MF A01.

The relationship between lake sensitivity to atmospheric acidic inputs and the neutralization capacity of watersheds is examined for 267 lakes in northeastern Minnesota. Three water chemistry/sensitivity measures (color, sulfate, and alkalinity) are correlated with variables representative of precipitation and sulfate inputs, hydrology, and the acid-neutralization capacity of various watershed components. An ordinal scale for ranking bedrock and surficial deposit neutralization capacity is presented. The watershed variables found to account for the largest percentages of the variability in measured color, sulfate, and alkalinity levels are determined. The results illustrate important averaging properties of watersheds from small headwater systems to large drainages and the difficulty in obtaining correlations for some water-quality measures (e.g., alkalinity) when some variables, such as soils and land cover, are available only as large-area averages.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13258, 13271, 13272, 13273, 13274, 13275, 13276, 13277, 13278, 13280, 13281, 13282, 13283, 13284, 13285, 13287, 13288, 13289, 13290, 13291, 13302, 13305, 14296, 14322, 14332

14369 **(EML—460, pp 214-223) Chernobyl fallout studies in the Black Sea and other ocean areas.** Livingston, H.D.; Clarke, W.R.; Honjo, S.; Izdar, E.; Konuk, T.; Degens, E.; Ittekkot, V. (Woods Hole Oceanographic Institution, MA). 1 Oct 1986. NTIS, PC A15/MF A01. File Number DE87001847.

In Compendium of the Environmental Measurements Laboratory's research projects related to the Chernobyl nuclear accident.

Because the Black Sea receives large amounts of river input from watersheds impacted by Chernobyl fallout, samples of water, plankton and soils in this area were collected for radionuclide analysis. Preliminary data are presented for cesium-137, cesium-134 and cesium-134/cesium-137 ratios in seawater. Plans for analysis of plankton, sediments and soils and for collection of seawater samples in the Norwegian Sea, the Barents Sea and Arctic ocean are described. 2 references, 1 figure, 3 tables.

14370 (INIS-mf—10100, pp 57) **Some results in computer calculation of aquatic dispersion of radionuclides released in the river.** Lazic, S.; Vukovic, Z. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14371 (INIS-mf—10100, pp 58) **Application of computer in evaluation of the distribution of radionuclides released into surface waters.** Hadzievski, L.; Anovski, T.; Kacurkov, D.; Minceva, B.; Andonovski, B.; Nikolovska, L. (Centar za Primena na Radioizotopi vo Stopanstvo, Skoplje, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14372 (INIS-mf—10100, pp 59) **Model calculations for transport of ^{3}H in groundwater systems.** Papesch, W.; Rank, D. (Bundesversuchs- und Forschungsanstalt Arsenal, Vienna, Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14373 **(Juel—2063) Regions with increased natural radioactivity. Pt. 4 Radon-222, radium-226 and uranium concentration in surface waters, ground water and drinking water in the Fichtelgebirge. Results of the measuring trip May/June 1984.** Sansoni, B.; Matthes, W.; Schnitzler, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung fuer Chemische Analysen). May 1986. 272p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE87750332.

Between May 23 and June 23, 1984, 169 specimens were taken of surface water and drinking water in the Fichtelgebirge, mainly from natural springs and wells in the granite region as well as in part from the drinking water supply. The uranium concentration was measured in the measuring van by a laser fluorimeter UA-3 (Scintrex); the water temperature, electrical conductivity, oxygen concentration and the pH value were determined by the Combibox (WTW). Furthermore, the discharge from the springs and wells was also determined. The concentration of radon-222 was emanometrically determined the following day in the field laboratory, while the radium-226 was separated overnight from the 20-1 water specimens by ion exchange at manganese dioxide columns. The radium-226 was later determined emanometically from the eluate in Juelich. Multi-element determinations by ICP atomic emission, atomic fluorescence and atomic absorption spectrometry were carried out in selected water specimens.

14374 (N—87-10263, pp vp) **MAPM: a coherent dual CO_2 laser DIAL system.** Grant, W.B.; Bogan, J.R. Aug 1986. NTIS, PC A15/MF A01. (NASA-CP—2431; L—16201; NAS—1.55:2431; CONF-8603134—).

From Seminar on advances in flocculation in the coal industry (ADFLOC); Nottingham, UK (19 Mar 1986).

The Mobile Atmospheric Pollutant Mapping System (MAPM) is a dual CO_2 laser DIAL system with heterodyne detection that is being developed for large distance range resolved measurement of organic solvent vapors and aerosol clouds. The components have been chosen to allow measurements to be made to distances of 6 to 7 km in a period of 20 to 30 s. The major components of the system are listed. MAPM is being integrated into a system and will be tested with several organic solvent gases and vapors in a remotely positioned sample chamber and with a free release of ethylene. Experimental results and system performance are discussed.

14375 (NIRS-RSD—61, pp 20-21) **Strontium-90 and cesium-137 in sea fish (from October 1981 to June 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in sea fishes (from October 1981 to June 1982) were determined. Fish was collected from eight sampling locations. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. The results are shown in a table.

14376 (NIRS-RSD—61, pp 22-23) **Strontium-90 and cesium-137 in shellfish (from February 1982 to July 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in shellfish (from February to July 1982) were determined. Approximately 4 kg of shellfish including the shells was collected or purchased from four sampling locations. The results are shown in a table.

14377 (NIRS-RSD—61, pp 24-25) **Strontium-90 and cesium-137 in seaweeds (from January 1982 to June 1982). Environmental and dietary materials.** Jun 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780545.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in seaweeds (from January to June 1982) were determined. Edible seaweeds were collected from six sampling locations. The results are shown in a table.

14378 (NIRS-RSD—63, pp 25-26) **Strontium-90 and cesium-137 in freshwater fish (from January 1982 to December 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in freshwater fishes (from January to December 1982) were determined. Fishes were collected from eight sampling locations. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. The results are shown in a table.

14379 (NIRS-RSD—63, pp 27-28) **Strontium-90 and cesium-137 in shellfish (from February 1982 to November 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in shellfish (from February to November 1982) were determined. Approximately 4 kg of shellfish including the shells were collected or purchased from four sampling locations. The results are shown in a table.

14380 (NIRS-RSD—63, pp 29-30) **Strontium-90 and cesium-137 in seaweeds (from February 1982 to October 1982). Environmental and dietary materials.** Dec 1982. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780546.

In Radioactivity survey data in Japan.

Strontium-90 and cesium-137 in seaweeds (from February to October 1982) were determined. Edible seaweeds were collected from a sampling location. The results are shown in a table.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 14362

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 13418

14381 **(NP—7900409) Mitigation options for fish and wildlife resources affected by port and other water-dependent developments in Tampa Bay, Florida.** Dial, R.S.; Deis, D.R. (Continental Shelf Associates, Inc., Jupiter, FL (USA)). Jun 1986. 170p. US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458. File Number TI87900409.

Ten past restoration projects in Tampa Bay were evaluated. Habitats included Spartina marsh, mangrove forests, Juncus marsh, and subtidal habitat. Success was difficult to determine because goals for each project had not been defined. In-kind losses of habitat occurred in all but one project. Permanent losses occurred in at least three projects. Restoration of Spartina and Juncus marshes was recommended. Mangroves will recruit into Spartina marshes, provided a seed source is available; planting of mangroves alone is not recommended. Seagrass restoration is not recommended at this time. Twelve sites, most less than 50 ha, were identified as potential restoration sites to give 344 ha of subtidal habitat to be made shallower and 176 ha of uplands to be scraped down. The current management program's legal and policy needs for improving environmental management, the role of mitigation, and the information needed to develop mitigation plans are discussed. This report will be useful to decisionmakers concerned with wetland habitat loss and restoration in Tampa Bay, Florida, and other areas with similar habitats.

5206 Regulations

REFER ALSO TO CITATION(S) 14345

14382 **(ORNL/M—193) Inventory of non-federally funded marine pollution research, development and monitoring activities: Northeast and Mid-Atlantic Region.** Caton, G.M.; Opresko, D.M.; Weaver, S.S.; Margulies, D. (ed.); Zacherle, A.W. (ed.). (Oak Ridge National Lab., TN (USA). Information Research and Analysis Div.; National Marine Pollution Program Office, Rockville, MD (USA)). Dec 1985. Contract AC05-84OR21400. 241p. NTIS, PC A11/MF A01; GPO Dep. File Number DE86015934.

This report includes descriptions of projects which were partially funded by the Federal Government, although the Federal contributions are not considered in the funding analyses. This report only considers marine pollution research, development, and monitoring activities. "Research" projects include studies, investigations, and surveys to study the sources, behavior, and effects of pollutants and polluting activities as well as studies concerning natural oceanic processes if these studies are conducted to improve understanding concerning pollutants and polluting activities. "Development" projects include efforts to provide analytical methods, instrumentation, and equipment necessary for research and monitoring of marine pollution. "Monitoring" projects include time-series observations of marine environmental conditions to determine the existing levels, trends in time and space, and natural variations in parameters measured. Some projects fall into the category of "compliance" monitoring. "Compliance" monitoring is generally undertaken for a permitted or licensed resource development activity to assure that an unacceptable level of environmental change has not occurred.

14383 **(PB—87-106969/XAB) Assessment of automated access to existing federal marine pollution data and information systems.** (National Oceanographic Data Center, Washington, DC (USA). Ocean Pollution Data and Information Center). Jun 1986. 40p. (OPDIN-INFORMAL—7). NTIS, PC A03/MF A01.

The objective of the Ocean Pollution Data and Information Network (OPDIN) under Section 8 of Public Law 95-273 is to improve the dissemination of information concerning Federal marine pollution-related projects. One means of improving dissemination is developing direct access and establishing a working knowledge with those systems that have automated data and information files. The Central Coordination and Referral Office (CCRO) maintains a description of the systems and services with pollution interests that are available from eleven Federal organizations. These systems and services range from completely automated, user-accessible systems of national interest, to non-automated services for retrieval of hard-copy materials and products of regional interest. This report focuses on the present CCRO access capabilities to those systems and identifies additional systems with potential access by the CCRO and its Network participants.

14384 **(PB—87-107751/XAB) Resource Conservation and Recovery Act (RCRA) ground-water monitoring technical enforcement guidance document. Final report.** (Environmental Protection Agency, Washington, DC (USA). Office of Waste Programs Enforcement). Sep 1986. 332p. (OSWER—9950.1). NTIS, PC A15/MF A01.

The report is a detailed presentation of the elements and procedures the U.S. Environmental Protection Agency deems essential to the design and operation of ground-water monitoring systems that meet the goals of the Resource Conservation and Recovery Act (RCRA) and its regulations. The essence of the guidance is that ground-water monitoring systems should be designed and operated to meet site-specific conditions, and founded on a good understanding of local hydrogeology. Further, the system should be designed and constructed to provide samples of ground water minimally affected by sampling activity.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

14385 **(AD-A—173827/7/XAB) Legislative environmental impact statement: small intercontinental ballistic missile program.** (Air Force Regional Civil Engineer, Norton AFB, CA (USA). Ballistic Missile Support). Nov 1986. 849p. NTIS, PC A99/MF E04.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Six different deployment areas are under consideration for each of the three basing modes. The areas under consideration for the Hard Mobile Launcher in Random Movement are located in Arizona, California, Florida, Nevada, New Mexico/Texas, and Washington; those for the Hard Mobile Launcher at Minuteman Facilities are situated in Missouri, Montana, North Dakota (two areas), South Dakota, and Wyoming/Nebraska/Colorado; and the areas for the Hard Silo in patterned Array are located in Arizona (three areas), California, New Mexico/Texas, and Wyoming. The number of missiles analyzed in any given area ranges from 50 to 250. The total force to be eventually deployed could range from 250 to 1000 missiles. The direct employment in any given area during the year of peak-construction activities could range from approximately 2100 workers to more than 5000, depending on the basing mode selected and the number of missiles deployed in the area. Potential project-induced environmental impacts in each area and for each basing mode are identified in the LEIS by the following categories: socio-economics, utilities, transportation, land use, cultural and paleontological resources, biological resources and threatened and endangered species, air quality and noise, water resources, and geology and soils.

14386 **(PB—87-121653/XAB) Legislative environmental impact statement: small intercontinental ballistic missile program.** (Department of the Air Force, Washington, DC (USA)). Nov 1986. 853p. NTIS, PC A99/MF E04.

The Legislative Environmental Impact Statement (LEIS) identifies and compares potential regional impacts of deployment and peacetime operation of the small ICBM in three alternative basing modes. Six different deployment areas are under consideration for each of the three basing modes. Potential project-induced

environmental impacts in each area and for each basing mode are identified in the LEIS by the following categories: socioeconomics, utilities, transportation, land use, cultural and paleontological resources, biological resources and threatened and endangered species, air quality and noise, water resources, and geology and soils.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 13180, 13181, 13183, 13184

55 BIOMEDICAL SCIENCES, BASIC STUDIES

14387 **Swine in biomedical research. V. 1.** Tumbleson, M.E. New York, NY; Plenum Press (1986). 698p. (CONF-8506326—). Plenum Publishing Corp., New York, N.Y.

From Conference on swine in biomedical research; Columbia, MO, USA (17 Jun 1985).

This volume presents information on the following topics: the history of pigs; conceptual and operational history of the development of miniature swine; breeding program and population standards of the Gottingen miniature swine; moral, social and scientific aspects of the use of swine in research; fertility in gilts inseminated with frozen boar semen stored at -196 C for eight years; ultrastructure of piglet liver; porcine models in surgical research; anesthesia in swine; pulse monitoring, intravascular and instramuscular injection sites in pigs; collagen biosynthesis and collagen content as a measure of dermal healing in experimental wounds in domestic swine; methods for hair removal; swine as a cardiac surgical model; bone marrow transplantation in miniature swine; technical aspects of small intestinal transplantation in young pigs; models; the pig in studies of diarrhea pathophysiology; use of swine to validate airflow perturbation device for airways resistance measurements in humans; swine as a model for human diabetes; and the weanling Yorkshire pig as an animal model for measuring percutaneous penetration.

14388 **Swine in biomedical research. V.2.** Tumbleson, M.E. New York, NY; Plenum Press (1986). 637p. (CONF-8506326—). Plenum Publishing Corp., New York, N.Y.

From Conference on swine in biomedical research; Columbia, MO, USA (17 Jun 1985).

This volume presents information on the following topics: the effect of dietary fiber on growing pigs; preparation of a cerebral perfusion model in the pig - anatomic considerations; a review of the utilization of lactose, glucose, sucrose, and cornstarch by neonatal piglets reared artificially; histology of piglet liver, swine hematology; use of swine as a model of musculoskeletal growth in animals; boar and human sperm as cellular models for membrane phospholipiid biosynthesis and degradation; a stereotaxic atlas of the developing swine (Sus Scrofa) forebrain; the effect of ethanol on liver mitochondrial Ca++-uptake; control of feed intake in pigs; the pig as a model of abberations associated with carbohydrate and lipid metabolism; whey and cholesterol in swine; vitamin and mineral nutrition and malnutrition; cadmium absorption, distribution and excretion in young and adult minature swine; a piglet model for infant total parenteral nutrition studies; swine in perinatal research; the endocrine pancreas of the fetal pig; cardiovascular physiology of the pig fetus; and the effect of sow's milk versus formula on the superior mesenteric blood flow of newborn piglets.

5501 Behavioral Biology

14389 **Mononuclear phagocyte proliferation and differentiation.** Stewart, C.C.; Walker, E.B.; Warner, N.L.; Walker, W.S. (Los Alamos National Lab., NM). pp 403-418 of Mononuclear phagocyte biology. Volkman, A. (ed.). New York, NY; Marcel Dekker, Inc. (1985).

Mononuclear phagocytes represent a diverse normal cell system that is capable of proliferation and which plays a major role in the host defense. Since these cells proliferate only in the presence of a growth factor, they can be used to study the biochemical and molecular biological events that occur in the initiation and maintenance of proliferation. In addition, their proliferative capacity offers a method by which pure populations of clonally derived cells can be obtained for functional analysis and differentiation potentiality. The role of tissue-derived substances that regulate functional expression can also be studied.

5502 Biochemistry

REFER ALSO TO CITATION(S) 13358, 14409

14390 **(AD-A—173832/7/XAB) Antimicrobial effects of various nutrient electrolyte beverages. Final report, 1981-1982.** Rowley, D.B.; Johnson, D.; Shattuck, G.E. (Army Natick Research and Development Center, MA (USA)). May 1986. 39p. (NATICK/TR—86/048). NTIS, PC A03/MF A01.

The purpose of this study was to determine if Staphylococcus aureus, Saccharomyces cerevisiae, or the mold Aspergillus flavus could survive and muliply in Quenchade, Gatorade, and other electrolyte beverages to the point of creating a stability problem or a health hazard to NBC encapsulated personnel. During periods longer than 6 h, such individuals may need liquid energy and electrolyte supplements (Na+ and Cl-) capable of being consumed through the drinking tube of their protective mask. Although S. aureus was inactivated due to the low pH (ca. f3.0) of the electrolyte beverages, antimicrobial agents sodium benzoate or potassium sorbate had to be added to prevent the multiplication of yeast and mold.

14391 **(DOE/ER/13368—3) Enzymology of acetone-butanol-isopropanol formation: Progress report, February 1, 1986-January 31, 1987.** Chen, J.S. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jan 1987. Contract FG05-85ER13368. 5p. NTIS, PC A02/MF A01. File Number DE87004394.

This project seeks to elucidate the property of enzymes catalyzing acetone-butanol-isopropanol formation in Clostridium beijerinckii. The emphasis is on characterization of isopropanol dehydrogenase and butanol dehydrogenase in respect to substrate and electron carrier specificities, and characterization of the enzyme(s) converting acetoacetyl CoA to acetoacetate. 4 refs., 1 fig.

14392 **(IC—85/27) Radio-frequency dielectric properties of some tropical African leaf vegetables.** Laogun, A.A.; Ajayi, N.O. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780511.

The variation of the relative permittivity epsilon'sub(r), the loss factor epsilon" and a.c. conductivity σ with the frequency of an applied electromagnetic field over the range 0.5 to 50 MHz has been studied in the leaf and stem tissues of three tropical vegetables viz, amaranthus, better leaf and okra. This is with a view to investigate the molecular structure and dielectric heating characteristics of the leaves and stems in the different vegetables considered. The Cole-Cole plots of the data showed that in all cases, both the stems and leaves exhibited a spread of relaxation times, indicating heterogeneity of structure. In general, the a.c. conductivity and the dielectric energy loss factor also appear to be much larger in the vegetable stems than in the leaves, suggesting that energy dissipation in stems is greater than in the leaves.

14393 **Films that wet without glow discharge.** Wall, J.S.; Hainfeld, J.F.; Chung, K.D. (Brookhaven National Lab., Upton, NY). pp 716-717 of Proceedings of the 43rd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1985).

The wet film technique for preparation of specimens for mass measurements with the Scanning Transmission Electron Microscope is described in detail. Specimens prepared by this technique have cleaner backgrounds and more sharply defined features than those prepared on glow-discharge grids. This technique has been applied to studies of ribosomal RNA, filamentous viruses, and pyruvate dehydrogenase. 3 references.

14394 Heavy atom cluster labeling of biological specimens. Lipka, J.J.; Hainfeld, J.F.; Wall, J.S. (Brookhaven National Lab., Upton, NY). pp 718-719 of Proceedings of the 43rd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1985).

Four different heavy metal clusters or heavy metal-containing complexes are described for labelling biological materials for study by means of scanning transmission electron microscopy (STEM) at dose rates as low as 30 el A^{-2}. The polyamine undecagold (11-Au) cluster ion, $[(p\text{-}H_8NCH_3C_6H_4)_3P]_7Au_{11}^{3+}$] has been used to covalently label the carbohydrate sites of the glycoprotein complex of human heptoglobin hemoglobin (Hp Hb). A second undecagold cluster which contains a single reactive malemide group has been used to label the two available sulfhydryls of the complex Hp Hb. A class of lipid-like heavy atom labels that are structurally derivations of the tetrahedrally symmetric ion phosphotungstic acid, $W_{12}PO_{40}^{3-}$, were found to incorporate into synthetic phosphatidylcholine bilayers when the n-alkyl chain was sufficiently long (n = 11 to 21). Functionalized alkyl-substituted heteropolytungstates have been synthesized and are expected to be useful for labelling nucleophilic protein residues. Reaction schemes are reported for preparation of these four types of clusters. 7 references.

14395 Alignment of low-dose STEM images of unstained macromolecules. Hainfeld, J.F.; Furcinitti, P.S.; Wall, J.S. (Brookhaven National Lab., Upton, NY). pp 162-163 of Proceedings of the 42nd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press Inc. (1984).

Several studies of molecular structure have successfully employed computer techniques to align images of single particles. Image processing software packages have also been developed to facilitate this work. Due to the low contrast and high beam damage rate involved in the use of unstained specimens, most single particle (i.e., non-crystalline) image alignment has been of negatively stained specimens. The scanning transmission electron microscopy (STEM), which has a linear transfer function at high resolution rather than the oscillating one inherent to CEMs, operationally overcomes these limitations by providing low dose, high contrast images of unstained material with high collection efficiency.

14396 Toward the biochemistry of individual molecules. Wall, J.S.; Hainfeld, J.F. (Brookhaven National Lab., Upton, NY). pp 154-157 of Proceedings of the 42nd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1984).

One goal of the Brookhaven STEM group is to enhance the capabilities of the electron microscope as a biochemical tool, while attempting to open up a new field: the Biochemistry of Individual Molecules. Three aspects of molecular biology seem particularly tractable with the STEM (Scanning Transmission Electron Microscopy): (1) size, shape and molecular weight; (2) active sites: location and environment; and (3) interactions in complex systems.

14397 Serum lipid and lipoprotein concentrations following exposure to ozone. Vaughan, W.J.; Adamson, G.L.; Lindgren, F.T.; Schooley, J.C. (Lawrence Berkeley Lab., CA). *JEPTO;* **5**: No. 4-5, 165-173(1984). Contract W-7405-ENG-48.

The effects of exposure to ozone (O_3) on concentrations of serum lipids and lipoproteins were investigated. Male and female guinea pigs were exposed to O_3 at 1 ppm for 2 weeks. Serum concentrations of cholesterol, triglycerides, low density (LDL) and very low density (VLDL) lipoproteins were elevated after O_3 exposure, especially in males. During O_3 exposure the food intake per day decreased (for a constant body weight), suggesting that metabolic rate and possibly basal metabolic rate were lower. Lung wet weights increased during O_3 exposure by 87% for males and 45% for females. When individual lung weight/body weight ratios were correlated with cholesterol and LDL values from the same animal, a high correlation was found for males ($r = 0.81$, P less than 0.05), suggesting that there may be a relationship between lipoprotein elevations and lung damage for males. Because elevated concentrations of lipids and lipoproteins in humans increase the risk of coronary heart disease (CHD), the lipoprotein results suggest that an epidemiological study of the incidence of CHD with metropolitan O_3 levels may be warranted.

14398 Undecagold labelling of glutamine synthetase from E. coli. Lipka, J.J.; Hainfeld, J.F.; Wall, J.S. (Brookhaven National Lab., Upton, NY). pp 158-159 of Proceedings of the 42nd annual meeting of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; San Francisco Press, Inc. (1984).

Glutamine synthetase (GS) from E. coli consists of 12 identical 50 kD subunits arranged in a double hexagon with one six-fold axis of rotational symmetry and six two-fold axes. The divalent cations Mn^{2+} or Co^{2+} induce the formation of linear face-to-face aggregates of individual GS molecules, resulting in the formation of long linear arrays, GS/sub n/. This aggregation is retarded and eventually reversed to the native form (GS) as the salt concentration increases. The authors have used an undecagold (11-Au) cluster ion, which induces similar aggregation of native GS, resulting in a wide distribution of ordered linear arrays of GS/sub n/ (where n=2-10, or more). These aggregates show the highly electron dense labels located exclusively at the face-to-face interaction surface. Specimens of the GS/sub n/ aggregates have been studies with the Brookhaven STEM and molecular weight values have been determined with the Brookhaven STEM mass measurement computer system.

14399 DNA repair in B. subtilis: the identification of a strain temperature inducible for SOS functions. Yasbin, R.E.; Andersen, B.J. pp 237-247 of Molecular cloning and gene regulation in bacilli. New York, NY; Academic Press, Inc. (1982). Contract AC02-78EV04964;AC02-81ER60017.

The relationship among the systems which control DNA repair, recombination and genetic exchange has been extensively characterized in the bacterium Escherichia coli and the results frequently extrapolated to explain molecular phenomena observed in other biological systems. The validity of this extrapolation is subject to debate. Certainly, in the study of DNA repair mechanisms, distinct differences have been recognized between those systems found in E. coli and those systems initially characterized in the Gram-positive bacterium Bacillus subtilis. This paper describes a B. subtilis strain YB1020 which is thermally inducible for some of the SOS functions.

5504 Genetics

REFER ALSO TO CITATION(S) 14472

14400 (DOE/ER/10873—1) The roles played by mitochondrial DNA and nuclear genes in reversions to fertility in S-type male-sterile maize: Progress report, April 1, 1985 through November 30, 1986. (Illinois Univ., Urbana (USA). Dept. of Plant Biology). 1986. Contract AC02-81ER10873. 7p. NTIS, PC A02/MF A01. File Number DE87004586.

Spontaneous cytoplasmic reversion to fertility of cms-S maize has been studied at the mitochondrial DNA (mtDNA) level in the three inbred line backgrounds M825, 38-11 and WF9. In the cases of M825 and 38-11, the free, linear plasmid-like molecules S1 and S2 are lost upon reversion. They are retained, however, upon reversion of cms-S in the WF9 nuclear background. Sequences homologous to S1 and S2 are found in the main mitochondrial genome of cms-S; thus they occur as both free and integrated versions. In M825 cytoplasmic revertants, the left end of the integrated S2 is always disrupted, as compared with the sterile progenitor, as evidenced by the loss of the left-most Pst-1 restriction site. In 38-11 revertants it is the left end of S1 that is disrupted. In the WF9 nuclear background, the integrated S1 and S2 sequences of revertants are not disrupted, but main mitochondrial regions flanking these integrated S sequences are rearranged. In all three inbred line backgrounds there is reorganization around the cytochrome oxidase I gene, while there is generally no rearrangement of the cytochrome oxidase II and apocytochrome B genes.

14401 **Monosomic analysis in diploid crop plants.** Weber, D.F. (Illinois State Univ., Normal). pp 333-378 of Cytogenetics of crop plants. Swaminathan, M.S.; Gupta, P.K.; Sinha, U. (eds.). Madras, India; MacMillian India Ltd. (1983).

Monosomics in diploid forms are extremely powerful experimental vehicles which have been utilized in numerous ways to explore the genome as described in this review. They are the plant counter-parts of aneuploids found in humans, and an understanding of these plant aneuploids might lead to a better understanding of comparable situations of man. The monosomic condition in diploid organisms is not transmitted because n-1 gametes abort; thus, it is necessary to generate them each time that they are to be utilized. All treatments (genetic and physical) which have been demonstrated capable of generating monosomics in diploid organisms affect post-meiotic cells, and for this reason, have been successful. The recent systematic generation of monosomics in tomato and especially in maize provides a readily available source of monosomics in diploid organisms for the first time. These monosomic types will undoubtedly be extremely important experimental types for future studies exploring univalent chromosome behavior and numerous genetic and biochemical problems of diploid crop plants.

5505 Metabolism

14402 **(DOE/SF/00098—T10) Light-induced DELTApH and DELTApsi in halobacterial vesicles related to sodium transport.** Kamo, N.; Racanclli, T.; Packer, L. (Lawrence Berkeley Lab., CA (USA)). [1986]. Contract AC03-76SF00098. 13p. NTIS, PC A02/MF A01. File Number DE87003013.

Membranes of Halobacterium halobium contain two retinoproteins, baceteriorhodopsin (BR/sub 568nm/) and halorhodopsin (HR/sub 588nm/). We have investigated the light- and sodium-dependent activities in vesicles from the HR containing R_1mR strain, and the BR + HR containing S_9 strain to study energy conversion and ion flow mechanisms. Simultaneous ΔpH and Δpsi measurements have been made with electrodes. In R_1mR vesicles, -Δpsi and H^+ uptake occurs in NaCl but not in KCl medium. In S_9 vesicles, net H^+ extrusion is reduced at high light intensity in NaCl but not KCl medium. Such results indicate Na^+/H^+ exchange in vesicles from both strains. As S_9 contains BR + HR, it is unclear whether the Na^+ extrusion is due to a Na^+/H^+ antiporter and/or HR which has been proposed to be a light driven Na^+ pump. To evaluate these concepts for Na^+ transport, the light intensity dependence and action of several membrane transport active agents have been compared. Digitoxin, electro-neutral exchangers (triphenyltin and monensin), and phloretin yielded similar results for HR (R_1mR) and HR + BR (S_9) vesicles. Moreover treatment of vesicles with carboxyl reacting reagents inhibited Na^+ dependent activity in both types of vesicles. Thus, common mechanisms of Na^+ transport are indicated in S_9 and R_1mR vesicles. 22 refs., 9 figs., 1 tab.

5506 Medicine

REFER ALSO TO CITATION(S) 13912, 14145, 14422, 14426, 14433, 15243

14403 **(CONF-8610204—1) Radiopharmaceutical development for diagnostic and therapeutic applications.** Srivastava, P.C. (Oak Ridge National Lab., TN (USA)). 31 Oct 1986. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87002624.

From Science and technology subcommittee meeting; Newark, NJ, USA (31 Oct 1986).

Several radioisotopes are currently being evaluated for radiopharmaceutical development. These include the radioisotopes of iodine for developmental, therapeutic and diagnostic applications by SPECT. Other metallic radioisotopes are being developed for diagnostic and therapeutic applications. All these radioisotopes (copper-64, osmium-191, and tungsten-188) are HFIR produced, except yttrium-90, which is a by-product of uranium fission. Osmium-191 decays by isomeric transition to iridium-191m (half-life 5 sec). A bed-side Os/Ir generator has been developed which allows bolus elution of pure iridium-191m for first-pass heart studies in adults and children. Potential use of radiolabeled nucleosides as tumor localization agents is also addressed. The utility of nucleosides coupled with tumor specific antibodies for improved selectivity in immunotherapy and diagnosis of tumor should be explored. New production and purification techniques for medical radioisotopes and new versatile agents for radiolabeling antibodies for wide-spread applications should be investigated.

14404 **(CONF-8611114—1) Medical isotopes at Oak Ridge National Laboratory.** Ottinger, C.L. (Oak Ridge National Lab., TN (USA)). 12 Nov 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. File Number DE87002622.

From Norwood Sertoma Club meeting; Knoxville, TN, USA (12 Nov 1986).

Radioisotopes have been in wide use in medicine for more than a quarter of a century, and they have become important tools in modern health care delivery. Approximately 40,000 medical procedures using radioisotopes are performed every day in the United States alone. There is a large support industry which provides supplies, manufactures the radioisotope products, and transports the products to the users. Thus, nuclear medicine represents not only a significant benefit in terms of health care but also a multi-billion-dollar economic enterprise. Supporting the routine clinical use of radioisotopes is a wide field of research which seeks to improve existing procedures and to develop new ones. This presentation discusses briefly the overall field of radioisotope applications in medicine and describes the current involvement of Oak Ridge National Laboratory (ORNL) in this field.

14405 **(DOE/ER/60210—T1) Development and evaluation of an improved high-resolution TOFPET camera: TOFPET II: Technical report.** (Texas Univ., Houston (USA). Health Science Center). 1986. Contract FG05-84ER60210. 41p. NTIS MF A01. File Number DE87004423.

A majority of the components for the TOFPET II positron camera have been prototyped and tested, including the gantry, detectors and electronics. It is anticipated that the completion of the construction phase will be accomplished by May 1, 1987. Some additional development effort will be needed in the time-of-flight electronics, however, this development can be carried out during the test and evaluation phase of the contract. The fourth and final year of this contract is devoted to testing and evaluating the TOFPET II camera. Preliminary testing has already begun together with the software development effort so that the total contract can be completed by the projected deadline of April 30, 1988. 4 figs., 5 tabs.

14406 **(INIS-mf—10103) Medical cyclotron facilities.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1984. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780534.

This report examines the separate proposals from the Austin Hospital and the Australian Atomic Energy Commission for a medical cyclotron facility. The proponents have argued that a cyclotron facility would benefit Australia in areas of patient care, availability and export of radioisotopes, and medical research. Positron emission tomography (PET) and neutron beam therapy are also examined.

14407 **(NIRS—25) National Institute of Radiological Sciences: Annual report, [April 1985-March 1986].** (National Inst. of Radiological Sciences, Chiba (Japan)). May 1986. 114p. NTIS (US Sales Only)06/MF A01. File Number DE87900431.

The Annual Report 1985-1986 of the National Institute of Radiological Sciences (NIRS) covers work performed April 1, 1985 to March 31, 1986. This report provides brief information on investigations conducted by the scientific staff in the Institute during this period. Basic research on the biological effects of tritium, studies on stochastic effects of irradiation and risk estimation, assessment of human exposures to environmental radiation, and medical use of accelerated heavy ions are described.

14408 **Intraarterial versus intravenous adriamycin in the rabbit Vx-2 tumor system.** Swistel, A.J.; Bading, J.R.; Raaf, J.H. (Memorial Sloan-Kettering Cancer Center, New York, NY). *Cancer (Philadelphia);* **53**: No. 6, 1397-1404(15 Mar 1984). Contract AC02-77EV04268.

From Annual meeting of the Society of Surgical Oncology; Denver, CO, USA (1-4 May 1983).

Intraarterial (IA) chemotherapy can theoretically result in a high tissue level of the drug with reduced systemic toxicity compared with intravenous (IV) administration. The authors compared these two modes of therapy using Adriamycin (doxorubicin) in the rabbit Vx-2 tumor system. Vx-2 implanted in hind limb muscle, and silastic catheters were placed in the jugular vein and femoral artery. Nuclear imaging of technetium-99m-labeled autologous erythrocytes in nine animals was used to measure the kinetics of tumor blood flow. Presence of tumor increased flow through the involved limb up to threefold. One minute following injection there was no difference in concentration of /sup 99m/Tc in tumor whether labeled cells were introduced IA or IV. Twelve rabbits received IA or IV Adriamycin (3 mg/kg), while eight animals received normal saline IA or IV as controls. Tumor progressed in all control rabbits, whereas there was an objective or complete response in 83% of animals receiving adriamycin. One hundred percent of those treated IA responded compared with 67% for IV. Median time to initial response in animals treated IA was 7 days versus 21 days for those treated IV. Thus, IA Adriamycin achieves a more complete and more rapid response than the drug given IV. This occurs despite a large tumor blood flow and rapid equilibrium using both methods.

14409 **Retinal location in purple membrane of Halobacterium halobium: a neutron diffraction study of membranes labelled in vivo with deuterated retinal.** Jubb, J.S.; Worcester, D.L.; Crespi, H.L.; Zaccaie, G. (MRC Lab. of Molecular Biology, Cambridge, England). *EMBO Journal;* **3**: No. 7, 1455-1461(1984).

Purple membranes were prepared by growing Halobacterium halobium in a medium containing nicotine (which inhibits biosynthesis of retinal) and the oxidation products of fully deuterated β-carotene. This allowed the in vivo incorporation of deuterated retinal into the membranes. The labelled membranes were crystalline and isomorphous with native membrane as determined by X-ray diffraction, and their optical absorption spectra were very similar. Neutron diffraction data for the two dimensional in-plane lattice from labelled and native membranes were analyzed by difference Fourier and direct methods to 8.6 A resolution. The difference Fourier shows the retinal to be located in the center of the bacteriorhodopsin molecule. The best fit to the data was obtained with the projection of retinal as a 10 A long rod forming an angle of $-40^{0} +/- 10^{0}$ with the x axis centered at x = -0.19 +/- 0.02, y = -0.35 +/- 0.02 in fractional unit cell coordinates. The main peak in the difference Fourier map is at x = -0.17, y = -0.33.

5507 Microbiology

REFER ALSO TO CITATION(S) 13036, 14399, 14402

14410 **(CBPF-NF—025/85) Study of magnetic properties of magnetotactic bacteria.** Wajnberg, E.; de Souza, L.H.; de Barros, H.G.; Esquivel, D.M.S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780494.

The average magnetic moment and its anisotropy are determined in natural samples of magnetotactic bacteria at 4.2 K using a SQUID magnetometer. The results are in good agreement with estimates made from electron micrographs.

5509 Pathology

REFER ALSO TO CITATION(S) 14415

5510 Physiological Systems

14411 **(AD-A—173745/1/XAB) Prediction of nuclear submariner adaptability from autonomic indices and Rorschach Inkblot responses. Interim report.** Weybrew, B.B.; Molish, H.B. (Naval Submarine Medical Research Lab., Groton, CT (USA)). 9 Sep 1986. 28p. (NSMRL—1080). NTIS, PC A03/MF A01.

To identify the most valid predictors of submariner adaptability, the authors derived 23 indices from the responses of 170 nuclear submariners to the Rorschach Inkblot Test, 11 measures of Autonomic Nervous System (ANS) reactivity to contrived stress, and five adjustment criteria. Factor analysis of this 39x39 correlation matrix yielded two Rorschach Factors, one of which correlated with three criterion dimensions. Two unique factors were also discovered, one, a structured ANS factor, and the other, a complex criterion scale. Selected Rorschach scores and, to a lesser extent, certain ANS indices emanating from this study, may be usefully-valid predictors of the adaptability of nuclear submariners during long patrols.

14412 **Phenotypic variation in metamorphosis and paedomorphosis in the salamander Ambystoma talpoideum.** Semlitsch, R.D.; Gibbons, J.W. (Univ. of Georgia, Aiken, SC). *Ecology (English Translation);* **66**: No. 4, 1123-1130(Aug 1985). Contract AC09-76SR00819.

Phenotypic variation in metamorphosis and paedomorphosis in the salamander Ambystoma talpoideum was examined to determine its environmental or genetic basis. Eight artificial ponds were maintained, four at each of two environmental treatments: constant water level, to simulate fish-free permanent breeding ponds, and gradual drying out, to simulate temporary breeding ponds. Two populations of salamanders were used, derived from two breeding ponds having different frequencies of paedomorphosis. The water level in the drying treatment was lowered during the last 10 wk of the experimental period with no apparent differences in water chemistry parameters between treatments and only a slight change in water temperature during the last 2 wk. The effects of water level were potentially confounded by those of water temperature, density of larvae, and amount food. Population differences in the frequency of metamorphosis and paedomorphosis could potentially represent genetic differences resulting from the different selective regimes that individuals encounter in breeding ponds varying in drying frequency. 35 references, 3 figures, 4 tables.

14413 **Population dynamics of Yellowstone grizzly bears.** Knight, R.R.; Eberhardt, L.L. (Montana State Univ., Bozeman). *Ecology (English Translation);* **66**: No. 2, 323-334(Apr 1985). Contract AC06-76RL01830.

Data on the population of grizzly bears in the environs of Yellowstone National Park suggest that the population has not recovered from the reductions following closure of garbage dumps in 1970 and 1971, and may continue to decline. A computer simulation model indicates that the risk of extirpation over the next 30 yr is small, if the present population parameters continue to prevail. A review an further analysis of the available data brings out the importance of enhancing adult female survival if the population is to recover, and assesses various research needs. In particular, a reliable index of population trend is needed to augment available data on the population. 12 references, 9 figures, 6 tables.

14414 **H^{+}-translocating ATPases: advances using membrane vesicles.** Sze, H. (Univ. of Maryland, College Park). *Annual Review of Plant Physiology;* **36**: 175-208(1985). Contract AS05-82ER13015.

In this paper, two primary active transport systems (H^{+} -ATPases) in plant cells are examined using membrane vesicles as a simple experimental tool. One electrogenic, H^{+} -translocating ATPase is vanadate-sensitive and associated with the plasma membrane. Another electrogenic, H^{+} -translocating ATPases is anion-

sensitive, and localized on the tonoplast (and perhaps other membranes). According to the working model, the plasma membrane and tonoplast-type H^+ -ATPases are detectable in inside-out plasma membrane and right-side-out tonoplast vesicles. The direction of H^+ pumping into these vesicles would be consistent with the results from intact cells where H^+ are extruded from the cell across the plasma membrane and pumped into the vacuole from the cytoplasm. Understanding the properties of H^+ -pumping ATPases using membrane vesicles has paved the way for studies to identify secondary active transport systems coupled to the proton electrochemical gradient. Redox-driven transport systems can also be studied directly using the isolated vesicles. As transport proteins are identified, the functional activities can be specifically studied after reconstitution of the purified protein(s) into phospholipid membrane vesicles. 154 references.

5520 Public Health

REFER ALSO TO CITATION(S) 13140, 13445, 14250, 14256, 14257, 14258, 14259, 14260, 14261, 14262, 14263, 14264, 14265, 14271, 14272, 14273, 14280, 14281, 14282, 14283, 14284, 14285, 14288, 14474, 14478, 15243

14415 **(PB—87-114740/XAB) Proposed national strategies for the prevention of leading work-related diseases and injuries. Part 1.** (Association of Schools of Public Health, Washington, DC (USA)). 1986. 86p. NTIS, PC A05/MF A01.

Preliminary strategies developed at the National Symposium on the Prevention of Leading Work Related Diseases and Injuries, held in Atlanta, Georgia on May 1 to 3, 1985 were revised, elaborated, and further developed. Strategies were developed for the prevention of occupational lung diseases, musculoskeletal injuries, occupational cancers, severe occupational traumatic injuries, and occupational cardiovascular diseases. Lung diseases considered included silicosis, asbestosis, lung cancer mesothelioma, coal workers' pneumoconiosis, byssinosis, occupational asthma, hypersensitivity pneumonitis, asphyxiation, irritation, pulmonary edema, brucellosis, psitticosis, anthrax, mycobacterioses, histoplasmosis, aspergillosis, and coccidioidomycosis. Occupational cancers were discussed as they occur in the lung, pleura, peritoneum, bladder, kidneys, blood, nasal cavity, skin, nasal sinuses, and liver.

5530 Agriculture And Food Technology

14416 **(AREAEE—280) Utilization of ionizing radiations and radioisotopes in plant breeding and crop improvement in Arab countries.** Abo-Hegazi, A.M.T. (Nuclear Research Centre, Inshas (Egypt)). 1983. 111p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780492.

A review for research work in the field of utilizing ionizing radiations and radioisotopes in plant breeding and crop improvement conducted in Arab countries has been summarized and discussed in the light of some economic features of the crop or the plant on national or regional (Arab) level. Among the 241 articles in the above mentioned fields reviewed, around 230 articles were conducted in Egypt, 6 in Iraq, 2 in Algeria, and 2 in Sudan. Some of the articles dealing with more than one crop and/or more than one type of radiation or radioisotope.

14417 (INIS-BR—559, pp 55-59) **In vitro mutant obtainment by irradiation of nucellar tissue of citrus (Citrus Sinensis Osb.).** Pasqual, M.; Ando, A.; Tulmann Neto, A.; Menten, J.O.M. (Empresa Catarinense de Pesquisa Agropecuaria S/A, Brazil; Centro de Energia Nuclear na Agricultura, Piracicaba, Brazil). 1984. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. File Number DE87700441. (CONF-8411283—).

From Regional workshop on nuclear techniques in crop production; Piracicaba, Brazil (19 Nov 1984).

Nucellus of cultivar Valencia (Citrus Sinensis, Osb.) extracted from fruits 12 weeks after fertilization, were gamma irradiated (0.1, 1.0, 2.0, 4.0, 8.0 and 12.0 kR) before inoculation in culture media (pH 5.7) which comprised of macro and micronutrients of medium MS to which were added (in mg/l): mesoinusitol, 100; pyroxidin HCl, 1; nicotinic acid, 1; thiamine HCl, 0.2; malt extract, 500; sacarose, 50,000; agar-agar, 8,000. They were then kept under 16 h light and 8h dark at a temperature of 27/sup 0/C. (M.A.C.).

14418 (INIS-BR—567, pp 15-16) **Research work to obtain pepper (Piper negrum L.) mutants resistant to Fusarium disease.** Ando, A.; Menten, J.O.M.; Tulmann Neto, A.; Albuquerque, F.C. de; Hirakata, K. (Centro de Energia Nuclear na Agricultura, Piracicaba, Brazil; Empresa Brasileira de Pesquisa Agropecuaria, Belem, Brazil. Centro de Pesquisa Agropecuaria do Tropico Umido; Instituto Experimental Agricola Tropical da Amazonia, Belem, Brazil). 1984. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700442. (CONF-8411283—Absts.).

From Regional workshop on nuclear techniques in crop production; Piracicaba, Brazil (19 Nov 1984).

14419 (INIS-BR—567, pp 24-25) **In vitro mutant obtainment by irradiation of nucellar tissue of Citrus (Pitrus sinensis Osb.).** Pasqual, M.; Ando, A.; Tulmann Neto, A.; Menten, J.O.M. (Empresa Catarinense de Pesquisa Agropecuaria S/A, Brazil; Centro de Energia Nuclear na Agricultura, Piracicaba, Brazil). 1984. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE87700442. (CONF-8411283—Absts.).

From Regional workshop on nuclear techniques in crop production; Piracicaba, Brazil (19 Nov 1984).

14420 (INIS-BR—567, pp 47-48) **Irradiation of foodstuffs. Possibilities and applications in agriculture.** Langerak, D.I. (State Institute for Quality Control of Agricultural Products, Wageningen, the Netherlands). 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE87700442. (CONF-8411283—Absts.).

From Regional workshop on nuclear techniques in crop production; Piracicaba, Brazil (19 Nov 1984).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 14417, 14419

14421 **(AD-A—173973/9/XAB) Ionizing radiation and chemical combat hazards: effects of time of exposure or combined hazards on performance in rats. Interim report, February 1980-August 1983.** Murphy, M.R.; Blick, D.W.; Dayton, T.E.; Goddard, G.A.; Wheeler, T.G. (Systems Research Labs., Inc., Dayton, OH (USA)). Sep 1986. 44p. NTIS, PC A03/MF A01.

The effects of combat hazards (radiation, nerve agent) on the performance of a well-learned task were investigated. In three experiments, independent variables included the time of day of exposure, dose, and whether or not exposure was to combine hazards. The ability of highly trained rats to perform a shuttle avoidance task was used as a performance model. In the first experiment, exposure to gamma radiation (1000 rads) occurred at one of six regularly spaced times of day, then, performance was tested for six times a day for two days thereafter. Striking circadian variation was seen in both general activity and shuttle performance. The time at which radiation exposure occurred did not affect average performance. However, different times of exposure were associated with different survival times. In the second experiment, the nerve agent soman (35 or 55 micrograms/kg) was injected at either 0830 or 2030. No effect of time of injection was found for the 35 micrograms/kg dose. The overall effect of soman in those animals able to perform the task was decreased latency to respond to the warning signal, an apparent facilitation of performance. In the third experiment, rats were exposed to both radiation and soman at doses that were behaviorally sign-free in the first two experiments to determine if the two hazards would combine to produce an effect.

14422 **(AD-A—174221/2/XAB) AFRRI (Armed Forces Radiobiology Research Institute) reports, July, August and September 1986. Technical report.** (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1986. 107p. NTIS, PC A06/MF A01.

Includes rept. nos. AFRRI-SR86-23 through AFRRI-SR86-33, AFRRI-TR86-2 and AFRRI-CR86-1.

Contents include: post-radiation regional cerebral blood flow in primates; heart-function studies in dogs after acute gamma irradiation of the precordium; the effect of anesthetic, sedative or narcotic drugs on intrahepatic and extrahepatic biliary kinetics; effect of gamma radiation on sodium channels in different conformations in neuroblastoma cells; effects of ethanol exposure on brain sodium channels; ionizing radiation alters the properties of sodium channels in rat brain synaptosomes; thymic hormones in thymus recovery from radiation injury; acute toxicity of petroleum- and shale-derived distillate fuel; light microscopic, hematologic, and serum chemistry studies; radioprotective properties of detoxified lipid A from Salmonella Minnesota R595; brain areas involved in production of morphine-induced locomotor hyperactivity of the C57B1/6J mouse; preliminary evaluation of US Army radiac detector DT-236/PD and radiac computer-indicator CP-696/UD; and calorimetric dose measurements and calorimetric system developed for the armed forces radiobiology research institute.

14423 **(CONF-870335—2) Status of personnel dosimetry accreditation programs in the United States.** Sims, C.S. (Oak Ridge National Lab., TN (USA)). Mar 1987. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003654.

From International conference on radiation dosimetry and safety; Taipei, China (2 Mar 1987).

The National Voluntary Laboratory Accreditation Program (NVLAP) is underway and many processors are becoming accredited. The NVLAP tests are not particularly difficult and there is a low failure rate. It seems relatively certain that NVLAP will continue for legal reasons even if the NRC does not issue rules requiring licensees to participate in the program. The Department of Energy Laboratory Accreditation Program (DOELAP) is just beginning, but it provides a more difficult test than NVLAP. It is aimed at improving dosimetry. Formal DOE Orders requiring participation have not been issued. The basic standard, ANSI N13.11, is due for review by the HPS in the near future. The appropriate standards review committee is being formed. Many people believe that several revisions (e.g., angular dependence, more categories, lower tolerance levels) will be made. 6 refs., 1 fig., 5 tabs.

14424 **(INIS-mf—10100) Computer aided methods in radiation protection. Hungarian-Austrian-Yugoslavian health physicists' meeting. Abstracts.** Feher, I. (ed.). (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Oct 1985. 63p. (CONF-851056—Absts.). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531.

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

Items within the scope of EDB have been entered individually into the data base. (ACR)

14425 (INIS-mf—10100, pp 28) **Dosimetry of radiation during homogeneous experimental irradiation of animals.** Kljajic, R.; Milosevic, Z.; Horsic, E. (Sarajevo Univ., Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14426 (INIS-mf—10100, pp 25) **Dose distribution, integral dose and radiation risk in computerized tomography of the skull.** Hofmann, W.; Rahim, H.; Mandl, H.; Grobovschek, M. (Salzburg Univ., Austria; Landeskrankenanstalten Salzburg, Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14427 (INIS-mf—10100, pp 10) **Compartment modelling study of stable iodine prophylaxis in relation to the daily iodine supply.** Turai, I.; Kanyar, B. (Orvostovabbkepzoe Intezet, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14428 (INIS-mf—10100, pp 1) **Derived values from intakes for evaluation of internal contamination monitoring results.** Andrasi, A.; Beleznay, E. Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14429 (INIS-mf—10100, pp 2) **Automated analysis in whole body counting of radiation workers.** Havlik, E.; Bergmann, H.; Hoefer, R. (Vienna Univ., Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14430 (INIS-mf—10100, pp 6) **Simple computer program for the estimation of range- and let distribution of alpha-particles in the tracheobronchial region.** Mukherjee, B. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14431 (INIS-mf—10100, pp 8) **Characteristics and incorporation monitoring results with a whole body counter.** Makra, S.; Reischl, G.; Karika, Z.; Fuezy, M.; Tarjan, G.; Sinkovics, I.; Beleznay, E.; Andrasi, A. (National Institute for Oncology, Budapest, Hungary; Hungarian Academy of Sciences, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14432 (INIS-mf—10100, pp 9) **Computer controlled whole body scanner for radiation protection purposes.** Urban, J.; Andrasi, A.; Beleznay, E. (Health Physics Dept., Budapest, Hungary; Hungarian Academy of Sciences, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14433 (INIS-mf—10100, pp 46) **Computer assisted evaluation of dose measurements of the hand.** Polgar, I.; Katona, E.; Somogyi, A. (Weil Emil Korhaz-Rendeloeintezet, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14434 (INIS-mf—10100, pp 47) **Using personal computer for an integrated personal dosimetry system.** Ouvrard, B.; Hochmann, R.; Gann, E. (International Atomic Energy Agency, Seibersdorf, Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14435 (INIS-mf—10100, pp 50) **Application possibilities of microcomputer for personal dosimetry evidence and manipulation of data.** Minevski, Z. (Institut za Medicinu Rada i Radiolosku Zastitu Dr. Dragomir Karajovic, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14436 (INIS-mf—10100, pp 51) **Algorithm for assessment of mean annual gonad dose and genetically significant dose from the data of personal dosimetry.** Tomasevic, M.; Radovanovic, R. (Clinical Centre of Medical Faculty Institute of Occupational and Radiological Health, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14437 (INIS-mf—10100, pp 52) **Model of standardizing dosimetric data collection.** Litido, M.; Tacconi, A. (ENEA, Bologna, Italy; USL 25, Italy). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14438 (INIS-mf—10100, pp 53) **Application of an automated system for evaluating the records of individual monitoring external radiation exposures.** Thek, G.; Bojter, I. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest, Hungary). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14439 (INIS-mf—10100, pp 54) **Computer based personal data recording system for occupationally exposed persons.** Tschurlovits, M.; Seymann, E.; Slanetz, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14440 (INIS-mf—10100, pp 55) **Microcomputer data processing in a TLD automated system for personnel dosimetry.** Prokic, M.; Glodic, S.; Hadzic, D. (Institut za Nuklearne Nauke Boris Kidric, Belgrade, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14441 (INIS-mf—10100, pp 56) **Computerized evaluation, registration and analysis of personal and work-place doses.** Losonczi, J. (Hungarian Academy of Sciences, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14442 (INIS-mf—10100, pp 5) **Lung dose calculations for inhaled alpha emitters using personal computers.** Hofmann, W.; Daschil, F. (Salzburg Univ., Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14443 (INIS-mf—10100, pp 23) **Monte Carlo calculation of the exposure dose due to the radioactive lightning rod.** Nikezic, D.; Markovic, P. (Kragujevac Univ., Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14444 **(ORNL—5889) ANDROS: A code for Assessment of Nuclide Doses and Risks with Option Selection.** Begovich, C.L.; Sjoreen, A.L.; Ohr, S.Y.; Chester, R.O. (Oak Ridge National Lab., TN (USA)). Nov 1986. Contract AC05-84OR21400. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE87004056.

ANDROS (Assessment of Nuclide Doses and Risks with Option Selection) is a computer code written to compute doses and health effects from atmospheric releases of radionuclides. ANDROS has been designed as an integral part of the CRRIS (Computerized Radiological Risk Investigation System). ANDROS reads air concentrations and environmental concentrations of radionuclides to produce tables of specified doses and health effects to selected organs via selected pathways (e.g., ingestion or air immersion). The calculation may be done for an individual at a specific location or for the population of the whole assessment grid. The user may request tables of specific effects for every assessment grid location. Along with the radionuclide concentrations, the code requires radionuclide decay data, dose and risk factors, and location-specific data, all of which are available within the CRRIS. This document is a user manual for ANDROS and presents the methodology used in this code.

14445 **(RERF-TR—4-79) Radiographic manifestations of diffuse idiopathic skeletal hyperostosis. A longitudinal study.** Ono, Minoru; Kudo, Sho; Russell, W.J. (Radiation Effects Research Foundation, Hiroshima (Japan)). Sep 1984. 22p. (In Japanese and English). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780548.

A relatively high frequency of hyperostosis in various body sites was found in 240 subjects with "diffuse idiopathic skeletal hyperostosis" (DISH) in the thoracic spine over an average observation period of 11 years. The onset and initial appearance of DISH in the thoracic spine were identified in 69 cases. The age at onset ranged from 40 to 65 years, and the initial sites involved were usually T9-10 and T10-11. As criteria in differentiating DISH from spondylosis deformans the hyperostoses anterior to the vertebral body itself appeared to be more important than the "bridges" anterior to the intervertebral spaces. Although it was difficult to differentiate the early appearance of DISH from spondylosis deformans in some cases, these long-term observations suggest that they are different entities.

14446 **(RERF-TR—15-83) Method for analysis of cancer incidence in atomic bomb survivors, with application to acute leukemia.** Pierce, D.A.; Preston, D.L.; Ishimaru, Toranosuke. (Radiation Effects Research Foundation, Hiroshima (Japan)). Sep 1984. 36p. (In Japanese and English). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780550.

Some statistical methodology developed for the analysis of the effect of radiation on cancer incidence is described. The methods presented make use of grouped data for estimation of and testing hypotheses about temporal aspects of the radiogenic effects on cancer incidence. The suggested approach is reviewed by its application to recent data on acute leukemia incidence in the RERF Life Span Study sample. The results of these analyses suggest that, although the temporal pattern of the radiogenic excess differs markedly by age at the time of the bomb (ATB), there is no statistically significant evidence of differences in total excess leukemia by age ATB throughout the study period.

14447 **(RERF-TR—19-79) Thoracic posterior longitudinal ligament ossification in a fixed population; longitudinal radiological observations.** Ono, Minoru; Russell, W.J.; Kudo, Sho. (Radiation Effects Research Foundation, Hiroshima (Japan)). May 1984. 16p. (In Japanese and English). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780551.

All lateral chest radiographs of 34 persons with posterior longitudinal ligament ossification (PLLO) in the thoracic spine were reviewed for date of its onset and its progress. These observations spanned as long as 18 years. Upper mid-thoracic PLLO first appeared under the age of 40, then increased in extent in the vertical axis until the age of 50. Lower thoracic PLLO occurred later than upper mid-thoracic PLLO. In the lower thoracic and lumbar regions, degeneration of the vertebrae and discs apparently were focal factors which triggered the development of thoracic PLLO. PLLO apparently developed in a different way in the upper and mid-thoracic regions, where the vertebrae and discs were unremarkable at the time of its initial appearance, and degenerative abnormalities did not predispose to it.

14448 **(RERF-TR—25-81) Taylor series approach to survival analysis.** Brodsky, J.B.; Groer, P.G. (Radiation Effects Research Foundation, Hiroshima (Japan)). Sep 1984. 23p. (In Japanese and English). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780552.

A method of survival analysis using hazard functions is developed. The method uses the well known mathematical theory for Taylor Series. Hypothesis tests of the adequacy of many statistical models, including proportional hazards and linear and/or quadratic dose responses, are obtained. A partial analysis of leukemia mortality in the Life Span Study cohort is used as an example. Furthermore, a relatively robust estimation procedure for the proportional hazards model is proposed.

14449 **Acute accidental inhalation of U: a 38-year follow-up.** Kathren, R.L.; Moore, R.H. (Pacific Northwest Lab., Richland, WA). *Health Physics;* No. 5, 609-619(Nov 1986).

The intake and deposition of U in three men accidentally exposed to soluble natural U compounds in an explosion in 1944 were reevaluated 38 y later by the U.S. Uranium Registry. The initial lung depositions were estimated to be about 40-50 mg of U based on the fragmentary urinary excretion data obtained shortly after the accident. The initial long-term bone deposition was estimated from individual excretion curves and was 410 micrograms (5.2 Bq) in the highest exposed individual, which resulted in an integrated 40-y dose equivalent to the bone surfaces approximately 2 mSv (200 mrem). Medical and health physics examinations of two of the men 38 y after the accident revealed no detectable deposition of U nor any physical findings attributable to U exposure. One of the exposed individuals showed an altered clearance pattern for U shortly after the accident, possibly from pulmonary edema associated with concomitant exposure to acid fumes.

14450 **Lung clearance and translocation of ^{239}Pu and ^{244}Cm in rats following inhalation individually or as a mixed oxide.** Rhoads, K.; Killand, B.W.; Mahaffey, J.A.; Sanders, C.L. (Pacific Northwest Lab., Richland, WA). *Health Physics;* No. 5, 633-640(Nov 1986).

Wistar rats were exposed via inhalation to aerosols of $^{239}PuO_2$, ^{244}Cm oxide or a mixed Pu-Cm oxide with an activity ratio of about 1:1. Activity in lung and several extrapulmonary tissues were examined up to 120 d after exposure to determine whether calcining Pu and Cm together affected lung clearance or translocation to other sites in the body for either nuclide. Initial deposition was about 1200 Bq (32 nCi) for $^{239}PuO_2$, 4200 Bq (115 nCi) for ^{244}Cm, and 2400 Bq (65 nCi) total alpha for the mixed oxide. The kinetics of single nuclides were as expected, with Pu oxide confined mainly to lung at all times and cleared with a half-time of 42 d. Curium was translocated rapidly to liver, with a peak activity of about 10% of the initial alveolar deposition at 7-14 d. Skeleton activity increased gradually, amounting to 12-15% of initial deposition near the end of the study. Lung clearance of Cm was more rapid than for Pu, with about 13% of Pu and less than 5% of Cm remaining at the end of the experiment. Both Pu and Cm remained in the lung somewhat longer when administered as a mixed oxide than the respective nuclides administered singly, and virtually all activity in the body was confined to the lung. Translocation of Cm to extrapulmonary tissues was almost entirely prevented by incorporation into the PuO_2 matrix. Therefore, calcining the two radionuclides together in an aerosol altered the kinetics of both following inhalation in rats, but most dramatically for ^{244}4Cm. The resulting change in radionuclide distribution for the lung and the body following such a mixed inhalation exposure would presumably alter the long-term health effects compared to those seen with the pure compounds.

14451 **Effectiveness of DTPA therapy when administered intragastrically or intraperitoneally to remove Pu from adult or neonatal rats.** Sullivan, M.F.; Ruemmler, P.S. (Pacific Northwest Lab., Richland, WA). *Health Physics;* No. 5, 641-646(Nov 1986).

Adult and neonatal rats were given ^{238}Pu by gavage or parenterally and treated with 0.5 mmoles/kg of calcium diethylenetriaminepentaacetate (DTPA), by gavage or parenterally, to determine its effectiveness for removing Pu. Parenteral administration of DTPA to adult rats 2 h after an intravenous ^{238}Pu injection was much more effective than intragastric treatment, removing nearly 70% of the retained dose. When ^{238}Pu was given to adults intragastrically (IG), followed by DTPA given either intraperitoneally (IP) or IG 2 h later, ^{238}Pu absorption increased while retention remained either unchanged, or increased. When neonates were given ^{238}Pu IG and treated 2 h later with intraperitoneal or intragastric DTPA, removal of ^{238}Pu was better than in adults: more than 80% of the ^{238}Pu that was absorbed and retained was removed by intragastric DTPA. When neonates were injected IP with ^{238}Pu, treatment with intraperitoneal DTPA was more effective for ^{238}Pu removal than intragastric treatment.

14452 **Serologic markers for hepatitis B among Marshallese accidentally exposed to fallout radiation in 1954.** Adams, W.H.; Fields, H.A.; Engle, J.R.; Hadler, S.C. (Brookhaven National Lab., Upton, NY). *Radiation Research;* No. 1, 74-79(Oct 1986).

At least one serologic marker of prior hepatitis B infection (hepatitis B surface antigen, antibody to surface antigen, or antibody to core antigen) was found in 91.7% of 314 Marshallese tested. The prevalence of hepatitis B surface antigenemia (3.3%) in a subpopulation that had resided on Rongelap Atoll at the time of accidental exposure to radioactive fallout from a thermonuclear test in 1954 did not differ significantly from the prevalence in a selected unexposed population (10.5%).

5602 Thermal Effects

14453 **Relative importance of temperature and diet to larval development and adult size of the winter stonefly, Soyedina carolinensis (Plecoptera: Nemouridae).** Sweeney, B.W.; Vannote, R.L.; Dodds, P.J. (Stroud Water Research Center, Avondale, PA). *Freshwater Biology;* 16: No. 1, 39-48(Feb 1986). Contract AC02-79EV10259.

Soyedina carolinensis Claassen, a leaf shredding stonefly, was reared in a series of three laboratory experiments from early instar to adult on different species of deciduous leaves and at various constant and fluctuating temperature regimes. Experiment 1, which involved rearing larvae on fourteen different leaf diets at ambient stream temperatures, showed that diet significantly affected larval growth and adult size but did not affect overall developmental time. Experiment 2, which involved rearing larvae on five different leaf diets at each of three fluctuating temperature regimes, showed that: adding 6°C to the normal temperature regime of WCC was lethal to 99% of the larvae regardless of diet; and warming WCC by 3°C did not affect developmental time but did significantly reduce adult size relative to adults reared at WCC temperatures on certain diets. Experiment 3, which involved rearing larvae on five different leaf diets at each of five constant temperatures showed that: temperature significantly affected the mortality, growth, and development time of larvae whereas diet only affected larval growth and mortality; temperatures at or near 10°C yielded maximum larval growth and survival for most diets; at 5°C, larval mortality was high and growth was low resulting in a few small

adults for most diets; larval mortality was at or near 100% at 15°C regardless of diet; and no larvae survived at 20 and 25°C.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 13445, 14245, 14248, 14286, 14307, 14387, 14387, 14421

14454 **(AD-A—173031/6/XAB) Inhalation toxicology. VIII. Establishing heat tolerance limits for rats and mice subjected to acute exposures at elevated air temperatures. Technical report, July 1978-January 1979.** Crane, C.R.; Sanders, D.C. (Federal Aviation Administration, Washington, DC (USA). Office of Aviation Medicine). May 1986. 12p. (DOT/FAA/AM—86/8). NTIS, PC A02/MF A01.

Experimental animal subjects are used most commonly to assess the toxicity of thermal decomposition products (smoke) from burning materials. Nascent smoke is obviously quite hot; therefore, the design of smoke toxicity assay systems must provide for adequate cooling of the gases prior to exposure of the animals. This research has addressed the question of how much cooling is required. Rats and mice were exposed to elevated air temperatures over the range of 38C to 110C. The exposure duration required to produce hyperthermic collapse (physical incapacitation) was measured for each temperature. A graph of time-to-collapse as function of exposure temperature was constructed for each species and statistically derived equations were fit to each data set. Times-to-collapse ranged, for the rat, from 60 minutes at 40C to less than 4 minutes at 110C. For the mouse, they ranged from approximately 60 minutes at 40C to 2.5 minutes at 90C. The significance of these findings as they relate to smoke toxicity testing is discussed.

14455 **(AD-A—174106/5/XAB) Enzyme decontamination of biological agents and the use of lectins to determine the pathogenicity of biological agents. Contractor report, October 19-83-September 1985.** Singh, J.S.; Doyle, R.J. (Louisville Univ., KY (USA)). Sep 1986. 96p. NTIS, PC A05/MF A01.

High concentrations of inorganic salts, such as 1M ammonium and/or sodium sulfate, caused the lysis of exponentially growing cultures of several organisms including, Bacillus anthracis 11966, B. anthracis 14185, B. cereus T, and B. thuringiensis 4042 presumably by activating their autolytic enzymes. This was further confirmed by performing viability counts. When spores were treated with molar salts, no decrease in the colony forming units was evident. The spores displayed instead, a clumping or agglutinating phenomenon perhaps due to their hyrophobic nature. A sensitive enzyme-linked lectinosorbent assay (ELLA) was developed based upon the hydrophobic nature of the spores. This could aid in the detection and identification of small numbers of organisms. The principle involves the use of specific lectins conjugated with horseradish peroxidase. Thus, when the conjugate selectively binds to bacteria which have been previously adsorbed to the bottom of a polystyrene microtiter plate and an enzyme substrate is subsequently added, a color reaction develops. It was shown that enzymes do indeed kill microorganisms, although a single enzyme would not kill all microorganisms. The salt-ELLA technique is the most sensitive method to quantitate spores of B. anthracis. Work on TNM showed the feasibility of using the reagent as a new type of disinfectant.

14456 **(EPRI-EA—4973) Investigation of methodologies for estimating human carcinogenic risk using nonhuman data: Final report.** Crump, K.S. (Crump (Kenny S.) and Co., Inc., Ruston, LA (USA); Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1986. 99p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920195.

The estimation of cancer hazards posed to humans from environmental chemicals is based, in most situations, on high dose animal studies. Hence cancer risk assessment involves at least two extrapolations: from high doses to low doses and from animals to humans. Issues related to the second extrapolation which have received attention and which need further investigation include the combination of different animal experiments (involving the same or different species), methods for accomplishing the extrapolation, and quantification of uncertainties associated with the extrapolation. Animal experiments typically differ with respect to doses administered, exposure durations, observation periods, and routes of exposure. Given a set of experiments comparable quality which one wishes to combine, it is necessary to account for those differences to accomplish the extrapolation to humans. The methods generally used have been to adjust the doses for experimental differences, then to combine the experiments to determine an overall estimate of the animal dose corresponding to a given risk, and then to extrapolate to humans by assuming that dose measured in equivalent units (e.g., mg/kg/ body wt/day) will provide the same risk to humans as to animals. Bayesian and log-normal techniques have been proposed for describing the uncertainty associated with animal-to-human extrapolation. A nonparametric extension of the latter proposal is suggested and the methods of estimating the uncertainty distribution are discussed. 54 refs., 3 figs., 18 tabs.

14457 **(GSF-BPT—5/86) Initiating and/or promoting activity of carcinogens discriminated by the Xiphophorus test system. Final report.** Anders, F.; Schmidt, C.-R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften). Aug 1984. 29p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751172.

Melanoma formation in Xiphophorus depends on the expression of the oncogene Tu in pigment cells. Normally, Tu expression is under stringent control of highly polygenic regulatory gene systems (R-Systems). Animals that are susceptible to melanoma contain defective R-Systems. We have constructed two strains of Xiphophorus, the one of which is sensitive to initiators (A) while the other responds to promotors (B). The sensitivity of strain A to initiators is based on the elimination of R-genes except for a particular Tu-linked pigment cell-specific R (R/sub Mel/). Impairment of R/sub Mel/ that can be induced by mutagenic carcinogens such as MNU and ENU, triggers melanoma formation. Promotors such as TPA, steroid hormones, etc. do not affect animals of strain A. The responsiveness of strain B to promotors is based on a) a complete dysfunction of the pigment cell-specific R-Systems permitting Tu expression and b) a genetic block of pigment cell differentiation by the 'golden' gene (g) protecting the fish from the development of melanoma. Agents such as TPA, steroid hormones, etc. induce pigment cell differentiation thus resulting in promotion of melanoma formation. A short-term test has been built up to detect suspicious carcinogens by determination of the sister chromatid exchange frequency after application on fish of testerstrain A. Molecular examinations on gene regulation by DNA methylation and oncogene activity revealed more details of the events during neoplastic transformation in Xiphophorus. With 93 refs., 3 tabs., 4 figs.

14458 **(GSF-BPT—8/85) Pollutant effects on the primary processes of photosynthesis.** Renger, G.; Graeber, P. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Bereich Projekttraegerschaften). 1985. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87751254.

Two relevant problems were investigated: I. The mechanism of pollutant effects (chemical substances, UV radiation etc.) on the primary processes of photosynthesis in isolated chloroplasts and whole plants. II. Development of a simple, microcomputer-controlled fluorometer for fast detection of plant damage resulting from a disturbance of the primary photosynthesis processes. Particular interest was taken into the mechanism of pollutant effects on Q/sub A/-Q/sub B/ apoprotein. It was found that the photosynthetic primary processes are not impaired until relatively high concentrations of heavy metal ions have been reached. Both UV-B and UV-C were found to destroy the reaction centers of photosystem II, inducing irreversible radiation damage. UV radiation also affects the water-oxydizing enzymatic system and the Q/sub A/-Q/sub B/ apoprotein. The present mechanistic studies indicate possible after-effects which require further investigation (e.g. by field tests etc.). In the technical part of the project, a fluorometer was developed for fast detection of pollutant effects on plants. The fluorometer was made reliable and easy to handle by installing a microcomputer.

14459 (INIS-mf—10063) Heavy metals effect in Drosophila melanogaster germinal cells. de la Rosa Duque, M.E. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1984. 96p. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. File Number DE86780522.

Heavy metals occur naturally and some of them are very important in cellular metabolism. Industrial development has increased metal concentration in the environment and in the living organisms' tissues. This increase promotes the human risk to suffer teratogenesis, carcinogenesis, and mutagenesis. Different biological systems have been used to proof the genetic effect of heavy metals including Drosophila. In the present work chromium, cadmium, lead, zinc, and arsenic salts were administered to Drosophila female and male adults in order to determine the genetic effect produced by these compounds, in both feminine and masculine germinal cells. The mating system used ("Oster males" and y²w/sup a//y²w/sup a/; e/e females) permitted one to determine among two successive generations, the mutagenic effects produced by heavy metals in Drosophila. The salts administration to adult flies was made by injection. Non-disjunction, X-chromosome loss, and sex linked recessive lethals frequency was increased by heavy metals. A fertility disminution between F 1 descendants from individuals treated with the metallic salts was observed. It was demonstrated that heavy metals can interact with genetic material at different levels in the two types of gametic cells to produce genetic damage.

14460 (INIS-mf—10100, pp 7) Aerosol deposition calculations with a stochastic lung model. Koblinger, L.; Hofmann, W. (Hungarian Academy of Sciences, Budapest; Salzburg Univ., Austria). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

14461 (Juel-Spez—364) IMA status seminar 'biotic damaging factors/epidemiology'. Summaries. Stuettgen, E. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Jul 1986. 45p. (In German). (CONF-8604287—Summs.). NTIS (US Sales Only), PC A03/MF A01. File Number DE87751176.

From IMA status seminar biotic damaging factors/epidemiology; Stuttgart, F.R. Germany (24 Apr 1986).

This workshop is concerned primarily with the effects of biotic factors on forest decline. The possible involvement of viruses, mycoplasma-like organisms (MLO), rickettsia-like bacteria (RLB), fungi, insects and nematodes in diseases and pests of forest trees has to be investigated. Beside abiotic factors these agents are the cause of different die-back symptoms and damage of trees, but it is not yet known to what extent they contribute to the symptoms man associate with the forest decline "Waldsterben".

14462 (PB—87-112066/XAB) Regulations, recommendations, and assessments extracted from RTECS. A subfile of the registry of toxic effects of chemical substances. Lewis, R.J.; Sweet, D.V. (Advanced Engineering and Planning Corp., Inc., Rockville, MD (USA)). Sep 1986. 440p. NTIS, PC A19/MF A01.

The volume is a subfile to the Registry of Toxic Effects of Chemical Substances (RTECS) for the use of those who have need of a convenient reference to specialized information. No toxicity data are included. The following criteria were used to select entries for the subfile: OSHA Standards; MSHA Standards; DOT Shipping and/or Labeling Regulations; NIOSH Recommendations; ACGIH Threshold Limit Values; IARC assessments indicating positive or suspected carcinogenic activity in animals and/or man; and NTP positive carcinogenesis test results. Substances are listed in alphabetical order of the prime entry name with cross reference included in the appendixes rather than embedded in the text. Included in the subfile are the RTECS Accession Number, Chemical Abstract Service (CAS) Registry Number, prime chemical name, synonyms, and data lines which meet selection criteria listed above. A total of 4284 chemical substanes are listed.

14463 (PB—87-115085/XAB) Mutagenic activity of irradiated C_2H_4/NOx mixtures in the presence of diethylhydroxylamine. Kleindienst, T.E.; Edney, E.O.; Namie, G.R.; Claxton, L.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). 1986. 9p. (EPA—600/J-86/178). NTIS, PC A02/MF A01.

Ethylene/oxides of nitrogen mixtures were irradiated in the absence and presence of diethylhydroxylamine. As previously reported, the presence of diethylhydroxylamine inhibited the photooxidation of the hydrocarbon and nitric oxide and the onset of ozone formation. Once the diethylhydroxylamine completely reacted, the ozone rose more rapidly, but to a lower level than in the absence of diethylhydroxylamine. Peroxyacetyl nitrate was also produced with the addition of diethylhydroxylamine. The reaction mixtures were tested for total mutagenic activity by gas-phase exposure to Salmonella typhimurium strain TA100. A significantly greater mutagenic activity was observed in the irradiated ethylene/diethylhydroxylamine/oxides of nitrogen mixture relative to the irradiated ethylene/oxides of nitrogen mixture. Only approx. 20% of the observed response could be accounted for by known reaction products.

14464 (PB—87-115093/XAB) Effects of inhalation of organic chemical air contaminants on murine lung host defenses. Aranyi, C.; O'Shea, W.J.; Graham, J.A.; Miller, F.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). 1986. 10p. (EPA—600/J-86/177). NTIS, PC A02/MF A01.

The potential health hazards of exposure to threshold limit value (TLV) concentrations of acetaldehyde, acrolein, propylene oxide, chloroform, methyl chloroform, carbon tetrachloride, allyl chloride, methylene chloride, ethylene trichloride, perchloroethylene, benzene, phenol, monochlorobenzene, and benzyl chloride, compounds which may be present in the ambient or work room atmosphere were investigated. The effects of single and multiple 3-hr inhalation exposures were evaluated in mice by monitoring changes in their susceptibility to experimentally induced streptococcus aerosol infection and pulmonary bactericidal activity to inhaled Klebsiella pneumoniae. When significant changes in these parameters were found, further exposures were performed at reduced vapor concentrations until the no-measurable-effect level was reached. Multiple exposures on 5 consecutive days were then performed at the concentration. Significant increases in susceptibility to respiratory streptococcus infection were observed after single 3-hr exposure to TLV concentrations of methylene chloride, perchloroethylene, and ethylene trichloride. For methylene chloride and perchloroethylene, these exposure conditions also resulted in significantly decreased pulmonary bactericidal activity.

14465 (PB—87-115648/XAB) Pathologic changes induced by coal-fired fly ash in hamster tracheal grafts. Schiff, L.J.; Graham, J.A. (IIT Research Inst., Chicago, IL (USA). Life Sciences Div.). 1984. 9p. NTIS, PC A02/MF A01.

The toxicity of fly ash from a coal-fired power plant for respiratory tract epithelium was studied in heterotropic tracheal grafts. Hamster tracheal grafts were continuously exposed to beeswax-cholesterol pellets containing 100, 1000 and 5000 micrograms fly ash and evaluated at 1, 2, 4, and 14-15 months of exposure. Histopathologic effects and the autoradiographic pattern of (^{3}H)thymidine incorporation were determined. In all concentrations of fly ash, an early mild submucosal inflammatory response was seen. Morphologic response of the tracheal epithelium was characterized by hyperplasia followed by squamous metaplasia and atrophic lesions. Although a rare papillomatous structure with cellular atypia was seen in grafts receiving 1000 micrograms fly ash, no carcinomas appeared during the 15-month observation period. Varying degrees of submucosal toxicity were also observed during the time period. Autoradiographic studies showed a significant increase in (^{3}H)thymidine incorporation in grafts receiving fly-ash treatment.

14466 **(PB—87-116430/XAB) Influence of ozone on pentobarbital pharmacokinetics in mice.** Graham, J.A.; Menzel, D.B.; Mole, M.L.; Miller, F.J.; Gardner, D.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). 1985. 11p. (EPA—600/J-85/451). NTIS, PC A02/MF A01.

It had been shown that 3- to 5-hr exposures to ambient concentrations of ozone (O_3) increase pentobarbital-induced sleeping time in female mice, hamsters, and rats without decreasing heptatic cytochrome P-450 levels or selected mixed function oxidases. To elucidate potential mechanisms involved, clearance of pentobarbital from the blood of O_3-exposed mice was examined. Pentobarbital clearance followed first-order kinetics with a one-compartment model. Mice exposed to 1960 micrograms per cu. m. (1ppm) for 5 hr had a 71% increase in the plasma half-life of pentobarbital. It therefore appears possible that pentobarbital-induced sleeping time is increased due to a decrease in hepatic metabolism of pentobarbital.

14467 **(PB—87-117420/XAB) Health assessment document for hydrogen sulfide: review draft.** Ammann, H.M.; Bradow, F.; Fennell, D.; Griffin, R.; Kearney, B. (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Aug 1986. 96p. (EPA—600/8-86/026A). NTIS, PC A05/MF A01.

Hydrogen sulfide is a highly toxic gas which is immediately lethal in concentrations greater than 2000 ppm. The toxic end-point is due to anoxia to brain and heart tissues which results from its interaction with the celluar enzyme cytochrome oxidase. Inhibition of the enzyme halts oxidative metabolism which is the primary energy source for cells. A second toxic end-point is the irritative effect of hydrogen sulfide on mucous membranes, particularly edema at sublethal doses (250 to 500 ppm) in which sufficient exposure occurs before conciousness is lost. Recovered victims of exposure report neurologic symptoms such as headache, fatigue, irritability, vertigo, and loss of libido. Long-term effects are similar to those caused by anoxia due to other toxic agents like CO, and probably are not due to specific H_2S effects. H_2S is not a cumulative poison. No mutagenic, carcinogenic, reproductive, or teratogenic effects have been reported in the literature.

14468 **(PB—87-131199/XAB) Pesticide Fact Sheet Number 103: cadmium pesticide compounds.** (Environmental Protection Agency, Washington, DC (USA). Office of Pesticide Programs). Sep 1986. 7p. (EPA—540/FS-87/126). NTIS, PC A02/MF A01.

The document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred. (1) Issuance or reissuance of a registration standard, (2) Issuance of each special review document, (3) Registration of a significantly changed use pattern, (4) Registration of a new chemical, or (5) An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

14469 **(PB—87-140265/XAB) Comparison of the toxicity of the combustion products from a flexible polyurethane foam and a polyester fabric evaluated separately and together by the NBS (National Bureau of Standards) toxicity-test method and a cone radiant-heater toxicity-test apparatus.** Levin, B.C.; Braun, E.; Gurman, J.L.; Paabo, M. (National Bureau of Standards, Washington, DC (USA). Center for Fire Research). Nov 1986. 71p. (NBSIR—86/3457). NTIS, PC A04/MF A01.

Representative specimens of flexible polyurethane foam and polyester fabric were thermally decomposed separately and together in order to compare the toxicity of the combustion products from the combined materials with those from the single homogeneous materials and to compare the toxicological results obtained with the NBS Toxicity Test Method with those using a cone radiant heater toxicity test apparatus. Gas concentrations (CO, CO_2, O_2 and HCN), blood carboxyhemoglobin, and LC_{50} values in Fischer 344 rats were determined for the materials under both flaming and nonflaming conditions. With the NBS Toxicity Test Method, the results of the non-flaming combined experiments indicated that both materials contributed in an additive manner to the concentration of the combustion products. However, under flaming conditions, the generation of HCN is greater than that predicted from the addition of the maximum amounts produced by the materials separately.

14470 **Relationship of histochemically detectable altered hepatocyte foci to hepatic tumorigenesis.** Peraino, C.; Staffeldt, E.F.; Carnes, B.A.; Ludeman, V.A.; Blomquist, J.A.; Vesselinovitch, S.D. (Argonne National Lab., IL). *IARC (International Agency for Research on Cancer) Scientific Publications;* No. 56, 37-55(1984). Contract W-31-109-ENG-38.

From Proceeding of a symposium of the Hungarian Cancer Society; Budapest, Hungary (16-18 May 1983).

A new experimental system was used to examine the stages of chemically induced hepatic neoplasia in the rat. The treatment protocol involved the intraperitoneal injection of a single non-necrogenic dose of carcinogen [N-nitrosodiethylamine (NDEA) or benzo[a]pyrene (BP)] into male and female rats within one day after birth, followed by dietary exposure to promoter (0.05% phenobarbital) from weaning. Rats were killed at intervals, and their livers were examined for tumors and for histochemically detectable foci of altered hepatocytes. The data showed that (1) the new treatment protocol was highly efficient in foci and tumor production; (2) growth rates and incidence levels of foci were directly related to hepatocarcinogenic effectiveness (NDEA > BP), whereas both carcinogens had similar effects on foci phenotypic properties; (3) after their formation, foci at a given level of phenotypic complexity did not become progressively more complex; (4) incidence levels of foci were sex-dependent (females > males), but growth rates of foci were the same for both sexes; (5) growth rates and growth capacities (ranges of possible growth rates) of foci were directly related to phenotypic complexity levels of foci; (6) frequencies and phenotypic complexities of foci were inversely related; the reverse was true for tumors, although 10% of the tumors were relatively simple (three markers or fewer); (7) marker frequency distribution patterns were completely different in foci and in tumors.

14471 **Repair of DNA adducts in asynchronous CHO cells and the role of repair in cell killing and mutation induction in synchronous cells treated with 7-bromoethylbenz[a]anthracene.** Thompson, L.H.; Brookman, K.W.; Mooney, C.L. (Lawrence Livermore National Lab., CA). *Somatic Cell and Molecular Genetics;* **10**: No. 2, 183-194(1984). Contract W-7405-ENG-48.

CHO cells of normal or UV-sensitive phenotypes were analyzed for their ability to remove DNA adducts produced by the carcinogen 7-BrMeBA. At a dose of 0.1 μM, which reduced the survival of the normal AA8 cells to ~90% and the mutant UV5 cells to ~20%, the frequency of adducts was 5-6 per 10^6 nucleotides for both cell types, and AA8 cells removed ~30% of the adducts in 8 h and ~55% in 24h. In contrast, UV5 and mutants from four other genetic complementation groups had no significant removal. At a dose of mutagen (0.07 μM) resulting in ~25% survival of asynchronous UV5, the survival of synchronous cultures rose about threefold from early G_1 to early S phase and then decreased somewhat in late S/G_2. At a dose (0.28 μM) producing similar survival of asynchronous cultures, AA8 cells differed qualitatively in that survival decreased progressively by 5- and 10-fold between early G_1 and the early part of S, and rose steeply through late S/G_2 to give a 10- to 20-fold increase. The authors conclude that DNA repair is the major determinant of variations in survival through the cycle in normal cells. The patterns observed are consistent with a mechanism of killing in AA8 cells in which adducts disrupt DNA replication, while in UV5 cells transcriptional blocks or other effects may govern lethality. Induced mutations at the aprt and hprt loci showed changes through the cycle in both AA8 and UV5 cells, and patterns were not readily explainable by the action of repair.

14472 **Procedures and evaluation of results of the mouse spot test.** Russell, L.B. (Oak Ridge National Lab., TN). pp 393-402 of Handbook of mutagenicity test procedures. Kilbey, B.J.; Legator, M.; Nichols, W.; Ramel, C. (eds.). Amsterdam, Netherlands; Elsevier Science Publishers BV (1984). Contract W-7405-ENG-26.

The in vivo somatic mutation test, or Mouse Spot Test (MST), was developed 25 years ago in radiation experiments and has, in more recent years, found increasing use in chemical mutagenesis studies. Results of the latter work were reviewed under the GENE-TOX program by Russell et al, who also recommended a protocol for the test. This basic protocol was subsequently invested with more detail by a group of investigators who met to exchange accounts of their experiences with the MST. The methods described in this chapter are based on these two accounts. The method involves exposing embryos that are heterozygous for a number of coat-color markers to the test agent and, 3 weeks later, looking for clones of mutant cells, i.e., spots of color expressing the recessive marker in an otherwise black fur (RS = recessive spot). The test therefore reveals any type of genetic alteration that can uncover a recessive at a marked locus. A positive RS result will classify an agent as a potential inducer of inherited genetic damage and/or potential carcinogen, and should be followed up by tests pertinent for risk assessment. A clearly negative RS result must be examined for the possibility that a placental barrier might have prevented the agent from reaching its target. If KS frequencies are not increased, while one or more of the other findings are positive (e.g. WMVS frequency, embryotoxicity, teratogenicity), it may be assumed that a placental barrier did not exist.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 14387

14473 **(AD-A—173846/7/XAB) Radhaz in the e and a area. Technical note.** Czigledy, R. (Materials Research Labs., Ascot Vale (Australia)). Feb 1986. 11p. (MRL-TN—498). NTIS, PC A02/MF A01.

An assessment is made of the probable level of r-f radiation hazard, Radhaz, generated in the Physical Chemistry Division of MRL by a transmitter operating in the neighbouring Engineering Design Establishment (Maribyrnong). The proposed transmitter would have a power output of 1000 watt and operate at frequencies from 2 to 30 MHz. An assessment was made of its induced effect on detonator leads.

14474 **(PB—87-117065/XAB) Health-hazard evaluation report HETA 85-153-1714, K and M Company, Torrance, California.** Seligman, P.J.; Gunter, B.; Okawa, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1986. 39p. (HETA—85-153-1714). NTIS, PC A03/MF A01.

Employees requested an evaluation of a cluster of breast cancer cases among Hispanic women at the facility and a determination of the advisability of pregnant women working with radio-frequency (RF) heat sealers. The initial report listed six breast cancer cases since 1979. RF heat sealers are used at the facility for producing vinyl notebooks and three ring binders. The rate of reported spontaneous abortions was 8.8% which does not exceed normal expectations for the general population (10 to 20%). Effects of low levels of RF exposure on pregnancies in humans are not known. The authors conclude that the incidence of breast cancer was higher than would be expected in the general public; reasons for this are unclear at present. The authors recommend additional shielding around 13 machines which failed to meet the American Conference of Governmental Industrial Hygienists magnetic field Threshold Limit Value of 0.27 amperes squared per meter squared.

14475 **Specialized management of a miniature swine herd for the EPRI electric field study.** Beamer, J.L; Horstman, G. (Battelle Paafic Northwest labs., Richland, WA). pp 217-222 of Swine in biomedical research. V.1. Tumbleson, M.E. New York, NY; Plenum Press (1986). (CONF-8506326—).

From Conference on swine in biomedical research; Columbia, MO, USA (17 Jun 1985).

Hanford Miniature Swine were exposed to 60-Hz electric fields simulating those under ultrahigh voltage transmission lines. External walls of the two quonset type buildings were constructed as a "sandwich," with two in of polyurethane foam as insulation between two sheets of fiberglass. Pen materials above floor level had to be nonconducting to influence minimally the field. Animals were housed in 5 x 6 ft pens constructed of fiberglass grating (1 1/2 in thick, 1 1/2 x 1 1/2 in lattice). Temperature, relative humidity and lighting were similar in the two barns. The unique housing and study environment necessitated innovations in swine husbandry practices and close scheduling because of the short access period which was only when the electric field was off (about four hr per day). Closed circuit television was used to monitor animal behavior, testing and farrowing. Boars for breeding were kept in shielded pens within each barn; only females were exposed to the electric field.

14476 **Development of a computerized system for managing a research swine herd.** Beamer, J.L.; Slavich, A.L. (Battelle Pacific Northwest Labs., Richland, WA). pp 223-228 of Swine in biomedical research, V.1. Tumbleson, M.E. New York, NY; Plenum Press (1986). (CONF-8506326—).

From Conference on swine in biomedical research; Columbia, MO, USA (17 Jun 1985).

A data management system is described for coordinating research activity involving a miniature swine population. Development of this computerized system evolved through three stages: compiling herd information, including genealogy, coordinating experimental events and daily, routine herd management. This system provided for collection of herd baseline information which was filed as essential animal statistics. When these data were applied with experimental protocols several parameters could be monitored and decisions facilitated, eg, status on swine estrus and gestation times with selection of appropriate breeding mates, schedule of events by animal relevant to critical experimental timing, initiation of nitritional adjustments and documentation of animal location changes. This system also afforded convenient input and easy retrieval of multidisciplinary experimental data including manipulation for analysis and report functions.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 13523

14477 **(AD-A—174387/1/XAB) Safety manual, Department of the Army, AMCR 385-100.** (Army Materiel Command, Alexandria, VA (USA)). 1 Aug 1985. 497p. NTIS, PC A21/MF A01.

Topics include: Nuclear weapon safety; Laboratory safety; Construction and utilities; Electrical equipment and wiring; Static electricity; Lightning protection; Technical industrial safety; Personal protective clothing and equipment; Storage and handling of military peculiar chemical materials and munitions; Fire protection; Specific chemicals; Explosive and ammunition; Quantity-distance storage criteria for liquid propellants; Safety requirements in specific hazardous areas; Quantity-distance requirements; Storage of explosives and ammunition; Hazard classification and storage compatibility system; Preparing explosives and ammunition for shipment; Railroad, motor vehicle, air, and water transportation; Materials handling equipment; Ammunition preservation, and packaging, modification, renovation and demilitarization.

14478 **(PB—87-113940/XAB) Investigation of fire and explosion accidents in the chemical, mining, and fuel-related industries - a manual. Bulletin.** Kuchta, J.M. (Bureau of Mines, Washington, DC (USA)). 1986. 93p. (BM-B—680). NTIS, PC A05/MF A01.

Library of Congress catalog card no. 85-600188.

The Bureau of Mines manual is oriented to the technical needs of an investigation of fire or explosion accidents and includes various practical and theoretical information needed in analyzing accidents or evaluating conditions that might lead to an accident. It is applicable to accidents in the chemical, mining, transportation, and other fuel-related industries. Specific procedures for conducting an accident investigation are outlined, and various guidelines are given for developing the fire or explosion evidence. Ignitability, flammability, and physiochemical data are presented for over 500 combustible gases, liquids, and solids; empirical and theoretical expressions are also given for extrapolating the behavior of combustible-oxidant-diluent systems to various environmental conditions. In addition, various data pertinent to damage analysis are summarized

to facilitate the task of the investigator in developing plausible accident scenarios.

58 GEOSCIENCES

14479 **Further suggestions for writing memorable geophysical papers.** Baker, D.N. (Los Alamos National Lab., NM). *EOS, Transactions, American Geophysical Union;* **66**: No. 37, 642(10 Sep 1985).

A tongue-in-cheek presentation is made of scientific literature titles which, by virtue of the author's names, have a humorous content. The basic orientation of the discussion is geophysics, although other scientific fields are occasionally mentioned. The author is a staff member at Los Alamos National Laboratory.

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 13271, 13272, 13273, 13274, 13275, 13276, 13277, 13278, 13279, 13280, 13281, 13282, 13283, 13284, 13285, 13286, 13287, 13288, 13289, 13290, 13291, 13292, 14358

14480 **(INIS-BR—563) Contribution to the geochronology of the Lages alkaline complex, state of Santa Catarina, Brazil.** Scheibe, L.F. (Sociedade Brasileira de Geologia, Sao Paulo). 1985. 9p. (In Portuguese). (CONF-8510375—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE87701291.

From 2. geology South Brazilian symposium; Florianopolis, Brazil (1 Oct 1985).

Field evidences and petrogentic inferences at the Lages alkaline complex are indicative of a lithological sequence, considering a single petrogenetic linneage: ultrabasic alkaline rocks, porphyritic phonolites, agpaitic phonolites, analcite trachytes, carbonatites and pipe breccias. Eleven new K/Ar determinations, as well as six already available, show a major concentration in the 65 to 75 m.y. range, with a mode of Ca. 70 m.y. in place of the previously preferred K/Ar age of 65 m.y. for the complex. A Rb/Sr whole rock reference isochron diagram of analytical results for phonolites from the Serra da Chapada gives an age of 82 +- m.y. and an initial Sr / sup 87//Sr/sup 86/ ratio of 0.7060 +- 0.0015 which is in good agreement, considering the analytical error with the 0.7052 and 0.7056 +- 0.0014 ratios determined for the Sr-rich porphiritic nepheline syenites from the Cerro Alto de Cima. A hystogram of K/Ar ages shows a preference for older ages in the porphyritic nepheline syenites, while the phonolites prefer the 65-70 m.y. range. Most of the pipe breccias plot between 70 and 75 m.y. The two younger ages are for the olivine melilitite and the Janjao Kimberlite. Disregarding possible analitical imprecisions, these tendencies ractify the younger age for the agpaitic phonolites when compared to the porphyritic nepheline syenites, but do not fit with the petrogenetic scheme indicated above. This overall picture may suggest a revision of the proposed sequence or, alternatively, be interpreted as an indirect evidence that the determined K/Ar ages do not represent the crystallization age of these rocks, but later thermal events, as suggested by Kawashita et al. (1984) for the Pocos de Caldas massif. (D.J.M.).

14481 **(INIS-BR—565) Petrology and geochronology of the Cacapava do Sul batholith, state of Rio Grande do Sul, Brazil.** Santori, P.L.P. (Sociedade Brasileira de Geologia, Sao Paulo). 1985. 14p. (In Portuguese). (CONF-8510375—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE87701293.

From 2. geology South Brazilian symposium; Florianopolis, Brazil (1 Oct 1985).

The batholith of Cacapava do Sul, Brazil, is composed of granitic rocks represented by leucogranites, syenogranites, monzogranites and granodiorites, arranged in a complex way. These rocks represent a calcalkaline suite of compressional tectonic setting. The general characteristics described with respect to it's petrography, chemical composition and geological setting show similarities with mesozone plutons. The pluton intruded the metamorphic rocks of the Vacacai Formation and the type of emplacement mechanism was forceful. According to the Rb-Sr total rock isochron age determinations, its consolidation took place throughout the Cambrian period. This result agrees with previous K-Ar age determinations. The intrusion occurred at the end of the Brasiliano orogenic cycle, when the metamorphic and folding phenomena had already ceased and the morphogenesis was in progress, since the temperature for radiometric argon retention was reached rapidly. (D.J.M.).

14482 **(LA—10880-MAP) Geologic map of the Ojo Caliente Quadrangle, Rio Arriba and Taos Counties, New Mexico.** Stix, J. (comp.). (Los Alamos National Lab., NM (USA)). Nov 1986. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004762.

The Ojo Caliente area forms part of the western limb of the Espanola basin within the Rio Grande rift of northern New Mexico (Manley, 1979; May, 1979). The geology consists of Miocene basin-fill sedimentary rocks that rest unconformably on, or are faulted against, Proterozoic crystalline metamorphic rocks. The Miocene rocks dip gently to the southeast, except where the attitudes are controlled by faulting or by the underlying basement topography. The Precambrian and Miocene rocks are unconformably overlain by Quaternary pediment and river gravels, loess, travertine, landslide debris, and alluvium. The Precambrian rocks are faulted into horsts in several areas by north - northeast - trending normal faults.

14483 (NUREG/CP—0079, pp 259-282) **Preliminary simulation model to determine ground-water flow and ages within the Palo Duro Basin hydrogeologic province.** Atwood, H.; Picking, L. (Stone and Webster Engineering Corp.). Aug 1986. NTIS, PC A25/MF A01 - GPO. File Number TI87002232. (PNL-SA—13796; CONF-8505180—).

From Symposium on groundwater flow and transport modeling for performance assessment of deep geologic disposal of radioactive waste; Albuquerque, NM, USA (20 May 1985).

Ground-water flow through the Palo Duro and Tucumcari Basins is simulated by developing a hydrogeolgic profile and applying a cross-sectional, finite-element, numerical model to the profile. The profile is 350 miles long and 2 miles deep and extends from east-central New Mexico to the Texas-Oklahoma border. It is comprised of hydrogeologic units that are identified from geophysical well logs, sample logs, and core descriptions. A hydrogeologic unit as used in this profile is a physically continuous rock sequence with hydrologic properties that are relatively consistent throughout and distinct from surrounding units. The resulting hydrogeologic profile, with the exception of the Ogallala Formation and the Dockum Group, is discretized into a 6000-element mesh and a 22,000-element mesh. Permeability values assigned to hydrogeologic units were, in part, calculated from drill stem tests conducted throughout the Palo Duro Basin. Ground-water age and travel paths are determined by applying Darcy's equation to selected flow lines. The 170 million-year age determined from ground-water at points within the Wolfcamp Series compares favorably with the geochemical data for this region. An age of 188 million years is determined for the Pennsylvanian granite wash.

14484 **(UCID—20836) Site characteristics report: UE11 (Yacht Hole).** Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004448.

This is a compilation of data pertaining to nuclear test containment at the UE11 borehole site at the Nevada Test Site. Most of the data presented here on the physical properties of rocks at the site come from previous investigations, but a resistivity survey to locate the subsurface expression of a fault, and determinations of grain density and CO_2 content were carried out for the purposes of this study. Details of the lithologic and geophysical characteristics of the Eleana Formation rocks are presented. A geologic map, including locations of faults in the vicinity of the borehole, and pertinent geologic cross-sections of the area are also included to illustrate the character of the subsurface around the UE11 site.

14485 (USGS-OFR—86-175) Geology of drill hole UE25p No. 1: A test hole into pre-Tertiary rocks near Yucca Mountain, southern Nevada. Carr, M.D.; Waddell, S.J.; Vick, G.S.; Stock, J.M.; Monsen, S.A.; Harris, A.G.; Cork, B.W.; Byers, F.M. Jr. (Geological Survey, Menlo Park, CA (USA)). 1986. Contract AI08-78ET44802. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87003865.

Yucca Mountain in southern Nye County, Nevada, has been proposed as a potential site for the underground disposal of high-level nuclear waste. An exploratory drill hole designated UE25p No. 1 was drilled 3 km east of the proposed repository site to investigate the geology and hydrology of the rocks that underlie the Tertiary volcanic and sedimentary rock sequence forming Yucca Mountain. Silurian dolomite assigned to the Roberts Mountain and Lone Mountain Formations was intersected below the Tertiary section between a depth of approximately 1244 m (4080 ft) and the bottom of the drill hole at 1807 m (5923 ft). These formations are part of an important regional carbonate aquifer in the deep groundwater system. Tertiary units deeper than 1139 m (3733 ft) in drill hole UE25p No. 1 are stratigraphically older than any units previously penetrated by drill holes at Yucca Mountain. These units are, in ascending order, the tuff of Yucca Flat, an unnamed calcified ash-flow tuff, and a sequence of clastic deposits. The upper part of the Tertiary sequence in drill hole UE25p No. 1 is similar to that found in other drill holes at Yucca Mountain. The Tertiary sequence is in fault contact with the Silurian rocks. This fault between Tertiary and Paleozoic rocks may correlate with the Fran Ridge fault, a steeply westward-dipping fault exposed approximately 0.5 km east of the drill hole. Another fault intersects UE25p No. 1 at 873 m (2863 ft), but its surface trace is concealed beneath the valley west of the Fran Ridge fault. The Paintbrush Canyon fault, the trace of which passes less than 100 m (330 ft) east of the drilling site, intersects drill hole UE25p No. 1 at a depth of approximately 78 m (255 ft). The drill hole apparently intersected the west flank of a structural high of pre-Tertiary rocks, near the eastern edge of the Crater Flat structural depression.

14486 Ternary diffusion coefficients of the brine systems NaCl (0.5 M)-Na_2SO_4 (0.5 M)-H_2O and NaCl (0.489 M)-$MgCl_2$ (0.051 M)-H_2O (seawater composition) at 25°C. Miller, D.G.; Ting, A.W.; Rard, J.A.; Eppstein, L.B. (Lawrence Livermore National Lab., CA). *Geochimica et Cosmochimica Acta;* **50**: No. 11, 2397-2403(Nov 1986). Contract W-7405-ENG-48.

Mutual diffusion coefficients have been measured by Rayleigh interferometry for two ternary brine compositions at 25°C: NaCl (0.5 M)-Na_2SO_4 (0.5 M)-H_2O and NaCl (0.489 M)-$MgCl_2$ (0.051 M)-H_2O. The latter is a ternary analog of seawater. Four diffusion coefficients are required to characterize a ternary system. The data show that the cross term diffusion coefficients are significant, and cannot be neglected in accurate geochemical modeling. Since d_{21} for NaCl-Na_2SO_4-H_2O is negative, a sufficient gradient of NaCl can cause Na_2SO_4 to move uphill against its own gradient. One of the cross term coefficients for NaCl-$MgCl_2$-H_2O is nearly as large as one of the main term coefficients.

14487 Crystallographic study of the low-temperature dehydration products of gypsum, $CaSO_4 \times 2H_2O$: hemihydrate $CaSO_4 \times 0.50H_2O$, and γ-$CaSO_4$. Lager, G.A.; Armbruster, T.; Rotella, F.J.; Jorgensen, J.D.; Hinks, D.G. (Univ. of Louisville, KY). *American Mineralogist;* **69**: No. 9-10, 910-918(Sep-Oct 1984).

The crystal structure of γ-$CaSO_4$ [a = 6,9694(8), c = 6.3033(4)A; Z = 3; space group $P6_222$] has been refined from time-of-flight neutral powder diffraction data to agreement factors of 4.92 (weighted profile R) and 12.10 (Rietveld R). The observed neutron powder profile for hemihydrate ($CaSO_4 \times 0.50D_2O$) is qualitatively consistent with a model in which the water molecules occupy two different levels in the channels of a distorted γ-$CaSO_4$ framework. Hemihydrates formed by dehydration of gypsum ($CaSO_4 \times 2H_2O$) or synthesized from concentrated solutions of HNO_3 are monoclinic with space group I2 [a = 12.062(4), b = 12,660(3) c = 6.930(1)A; γ = 90°]. Experimental data do not support the existence of a high-temperature trigonal form. Hemihydrate crystals grown in saturated NaCl solution contain ca 0.50 wt.% Na_2O. The presence of Na stabilizes the structure and produces significant changes in the refractive indices and unit-cell parameters. 24 references, 7 figures, 3 tables.

5802 Geophysics

REFER ALSO TO CITATION(S) 14179, 14186, 14187, 14188, 14189, 14190, 14191, 14192, 14193, 14194, 14195, 14196, 14197, 14198, 14199, 14200, 14201, 14202, 14203, 14204

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 13300, 14493

14488 (DOE/ER/71045—T1) Porosity with fluids: Origin and effects on physical properties of crustal rocks: Final report for 1985/86. (Stanford Univ., CA (USA)). 1986. Contract AS03-76ER71045. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004373.

Physical phenomena in cracked and porous rocks with fluids was investigated, and the results applied to geophysical exploration, reservoir evaluation and the study of shallow crustal rocks. The properties studied include wave propagation, dielectric properties, network modeling, and nuclear magnetic resonance. (ACR)

14489 Low albite, $NaAlSi_3O_8$: neutron diffraction study of crystal structure at 13 K. Smith, J.V.; Artioli, G.; Kvick, A. (Univ. of Chicago, IL). *American Mineralogist;* **71**: No. 5-6, 727-733(May-Jun 1986).

The crystal structure of low albite, Amelia, Virginia, was determined at 13 K by neutron diffraction (a = 8.1151(8), b = 12.7621(25), c = 7.1576(6) A, α = 94.218(12)°, β = 116.803(8)°, γ = 87.707(13)°, Cl vector). Mean T-O distances are T_1O 1.743, T_1m 1.611, T_2O 1.615, T_2m 1.616 A. Refinement of scattering lengths yields the following populations: T_1O 0.997(4) Al; T_1m 1.001(3) Si; T_2O 1.002(3) Si; T_2m 1.006(4) Si; Na 0.972(1) Na. The displacement of the Na atom is represented by an ellipsoid (root-mean-square amplitudes 0.065, 0.073, and 0.108 A) whose shorter axes are constrained by the five near oxygen atoms at 2.361, 2.419, 2.438, 2.500, and 2.614 A. The displacements of all atoms (B/sub iso/: Si 0.19, Al 0.02, O 0.29-0.42, Na 0.56 A^2) are similar to those for natrolite an scolecite at 20 K and are consistent with qualitative expectations for the zero-point energy. Stereo-chemical interpretation of the T-O distances at low temperature in low albite, natrolite, scolecite, quartz, and cristobalite is incomplete when only first neighbors are considered.

14490 Sample manipulator and quenching apparatus for high-temperature, 1-atm experiments. Naney, M.T.; Ward, F.H. (Oak Ridge National Lab., TN). *American Mineralogist;* **71**: No. 5-6, 837-838(May-Jun 1986).

A self-aligning, guide-track apparatus has been adapted to a vertical-tube gas-mixing furnace for use in sample loading and quenching of high-temperature, 1-atm experiments. This apparatus facilitates experimentation with materials that cannot - or should not - be attached to a platinum wire-loop.

14491 Cross-hole acoustic surveying in basalt. Rezowalli, J.J.; King, M.S.; Myer, L.R. (Lawrence Berkeley Lab., CA). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts;* **21**: No. 4, 213-216(Aug 1984). Contract AC03-76SF00098.

The purpose of this Technical Note is to present preliminary results of a series of cross-hole acoustic measurements performed in a tunnel situated in a basaltic rock mass. The tunnel, as a sub-surface depth of 46 m, was excavated by conventional drill-and-blast techniques. Located well above the water table, the rock mass is characterized as dense basalt with a jointing structure of 0.15-0.36 m thick vertical columns cut by low-angle cross joints. The objectives of the test program were: first, to evaluate in situ dynamic elastic properties, and to assess their spatial variation around the opening; second, to evaluate the extent of blast damage around the opening; and third, to assess the spatial variation of jointing and fracturing around the opening. Analysis of the velocities and fre-

quency spectra of compressional and shear waves transmitted through the rock. 10 references.

5804 Geochemistry

REFER ALSO TO CITATION(S) 13267, 14358

14492 (UCID—20864) Geochemical modeling (EQ3/6) plan: Office of Civilian Radioactive Waste Management Program. McKenzie, W.F.; Wolery, T.J.; Delany, J.M.; Silva, R.J.; Jackson, K.J.; Bourcier, W.L.; Emerson, D.O. (Lawrence Livermore National Lab., CA (USA)). 28 Aug 1986. Contract W-7405-ENG-48. 79p. NTIS, PC A05/MF A01; GPO Dep. File Number DE87004454.

This plan replaces an earlier plan for the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. It includes activities for all repository projects in the Office of Geologic Repositories: NNWSI, the Basalt Waste Isolation Project, the Salt Repository Project, and the Crystalline Project. Each of these projects is part of the Office of Civilian Radioactive Waste Management (OCRWM) Program. The scope of work for fiscal years 1986 to 1992 includes the work required to upgrade the geochemical codes and supporting data bases, to permit modeling of chemical processes associated with nuclear waste repositories in four geological environments: tuff, salt, basalt, and crystalline rock. Planned tasks include theoretical studies and code development to take account of the effects of precipitation kinetics, sorption, solid solutions, glass/water interactions, variable gas fugacities, and simple mass transport. Recent progress has been made in the ability of the codes to account for precipitation kinetics, highly-saline solutions, and solid solutions. Transition state theory was re-examined resulting in new insights that will provide the foundation for further improvements necessary to model chemical kinetics. Currently there is an increased effort that is concentrated on the supporting data base. For aqueous species and solid phases, specific to nuclear waste, requisite thermodynamic values reported in the literature are being evaluated and for cases where essential data is lacking, laboratory measurements will be carried out. Significant modifications and expansions have been made to the data base. During FY86, the total number of species in the data base has almost doubled and many improvements have been made with regard to consistency, organization, user applications, and documentation. Two Ridge computers using a RISC implementation of UNIX were installed; they are completely dedicated EQ3/6 machines.

14493 Partitioning of zirconium between clinopyroxene and magmatic liquids of intermediate composition. Watson, E.B.; Ryerson, F.J. (Rensselaer Polytechnic Institute, Troy, NY). *Geochimica et Cosmochimica Acta;* **50**: No. 11, 2523-2526(Nov 1986).

The partitioning of Zr between clinopyroxenes and hydrous, intermediate magmatic liquids was investigated in a series of experiments at 9-10 kbar and 950°-1000°C. The mean of seven measurements of the clinopyroxene/melt partition coefficient is 0.27, in good agreement with estimates based on phenocryst/matrix concentration ratios in natural rocks.

14494 Partition of noble gases between olivine and basalt melt. Hiyagon, H.; Ozima, M. (Univ. of Tokyo, Japan). *Geochimica et Cosmochimica Acta;* **50**: No. 9, 2045-2057(Sep 1986). Contract AA03-76SF00034.

The distribution coefficients (K/sub i/) of noble gases were determined for synthesized olivine-basalt melt pairs. Seven samples (BH-series) were synthesized at 1370 ~ 1300°C under a one atmospheric pressure (~ 10^5 Pa) noble gas mixture, and four samples (HPP- and HPG-series) at 1360-1050°C at high pressures (0.2 - 1.5 GPa). The two different experiments gave consistent results with each other. Some BH-series olivine samples were apparently contaminated with gas-rich inclusions or the glass phase, and the effects of such interferences on the calculated distribution coefficients were evaluated. The possible ranges of the distribution coefficients of noble gases thus obtained are: K/sub He/ ≦ 0.07, K/sub Ne/ = 0.006-0.08, K/sub Ar/ = 0.05-0.15, K/sub Kr/ ≦ 0.15, and K/sub Xe/ ≦ 0.3. These show remarkable features compared to solid element distribution coefficients: the distribution coefficients of noble gases are rather insensitive to, or even positively correlated with the atomic size of noble gases. The striking contrast between the partition of noble gases and that of solid elements may be attributed to the electrical neutrality of noble gases and the increasing electronic polarizability from He to Xe.

14495 Solution properties of silicate liquids from thermal diffusion experiments. Lesher, C.E.; Walker, D. (Columbia Univ., Palisades, NY). *Geochimica et Cosmochimica Acta;* **50**: No. 7, 1397(Jul 1986). Contract FG02-84ER13287.

Experimental thermal diffusion (Soret) fractionation of silicate liquids shows SiO_2 to be the principal ingredient of the component fractionating to the hot end of experimental charges. The chemical characteristics of disequilibrium Soret separations resemble those of equilibrium 2-liquid phase separation. This reflects the fact that liquid structural constitution does not depend upon the process leading to chemical separation. The activity-composition relations which lead to silicate liquid immiscibility strongly influence the Soret fractionation behavior of liquids near the solvus. This is especially well illustrated in the system Fa-Lc-Q. The temperature versus composition features of the steady state thermal diffusion profiles may be adequately described by an asymmetric regular solution model for silicate liquids, in contrast to any simpler solution model. This model can be used to quantify Margules parameters and the heat of transport for SiO_2 in these silicate liquids. Observation of the rise time and steady state values of Soret fractionation allows calculation of ordinary and thermal diffusion coefficients for SiO_2.

14496 System NaCl-H_2O: relations of vapor-liquid near the critical temperature of water and of vapor-liquid-halite from 300° to 500°C. Bischoff, J.L.; Rosenbauer, R.J. (Geological Survey, Menlo Park, CA). *Geochimica et Cosmochimica Acta;* **50**: No. 7, 1437-1444(Jul 1986). Contract AC03-76SF00098.

Vapor-liquid relations (P-T-x) for the system NaCl-H_2O were determined experimentally at temperatures spanning the critical temperature of water (T/sub c/), the lowest temperature in the system at which critical behavior occurs. In addition, vapor-liquid-halite P-T-x (vapor) relations were determined from 300° to 500°C. Results show that at 373.0°C, immediately below T/sub c/, the vapor side of the isothermal vapor-liquid P-x boundary has a shape quite different from that previously conceived. The NaCl content of the vapor increases with pressure in a smooth manner from the pressure of the three-phase assemblage (135 bars, 0.0029% NaCl), to a pressure just below that of the vapor pressure of pure water (0.012% NaCl at 184 bars). Above this pressure the boundary abruptly reverses and projects asymptotically to 0% NaCl in a beak-like shape at 218 bars, the vapor pressure of pure water. At 375.5°, slightly above T/sub c/, the asymptote disappears, and is replaced by a rounded nose. At progressively higher temperatures, the nose disappears and by 380°C the familiar symmetrical bell-shaped curve predominates with the critical point defined by the top of the bell. The P-T curve of the three-phase assemblage determined in the present study is in agreement with previous workers. The NaCl content of the three-phase vapor, however, is much higher than some literature values at temperatures above 410°C.

14497 Thermodynamics of NaCl in steam. Pitzer, K.S.; Pabalan, R.T. (Univ. of California, Berkeley). *Geochimica et Cosmochimica Acta;* **50**: No. 7, 1445-1454(Jul 1986). Contract AC03-76SF00098.

On the basis of the statistical mechanics of a two-component imperfect gas, a successive hydration model is developed for the NaCl ion-pair molecule in steam which fits satisfactorily an extensive array of experimental solubility data including the measurements of Bischoff et al. at the three-phase pressure from 300° to 503°C and other concordant measurements extending to 600°C at 290 bars. Some published experimental results depart substantially from the concordant set here selected. The theoretical basis of this model should make it useful for estimates at higher temperatures provided the mean hydration number and the total fluid density remain within the range corresponding to the fitted data. The measurements of Bodnar et al. at 500 bars and 800° and 825°C provide a test and the agreement with model predictions is good.

14498 Kinetics of dissolution of nepheline ($NaAlSiO_4$). Tole, M.P.; Lasage, A.C.; Pantano, C.; White, W.B. (Pennsylvania State Univ., University Park). *Geochimica et Cosmochimica Acta;* **50**: No. 3, 379-392(Mar 1986). Contract AC09-79ET41900.

Nepheline shows first order, congruent dissolution rates, followed by a lowering of the rates due to precipitation of new phases from solution, initially aluminum hydroxides, and later, as the activity of silica in solution increases, amorphous aluminosilicates. The reaction rates obey the law: R/sub imeas/ = R/sub idiss/ - Σ/sub j/ R/sub iprec/ where R/sub imeas/ is the measured rate of input of ion i into solution during dissolution of nepheline, R/sub idiss/ is the true rate of nepheline dissolution, and Σ/sub j/ R/sub iprec/ is the rate of removal of ion i from solution, either by precipitation or adsorption, summed over all the precipitated phases, j, that incorporate the ion, i. This law predicts that the concentration of ion, i, in solution should increase asymptotically to a steady state value, determined by the ratio of the rate of input of i into solution by nepheline dissolution and the rate of its removal from solution by precipitation or adsorption. At low pH, rates of dissolution (R/sub idiss) obey the law: R/sub idiss/ = k/sub +/(a/sub H+/)/sup 1.0/, while at high pH, the rate law is R/sub idiss/ = k/sub +/(a/sub H+/)/sup -0.2/. Nepheline dissolution rates (R/sub idiss) exhibit a minimum in the pH range 5-7. Initial rates of consumption of protons indicate that in the acid pH region, a positively charged complex is formed on the nepheline surface by adsorption of protrons. It is postulated that it is the rate of breakdown of the surface complex so formed which determines the rate of dissolution of nepheline. Activation energies for the dissolution of nepheline are in the range 53-77 kJ/mole. Addition of 3 m NaCl to the aqueous solution at pH 5 and 60°C lowers the dissolution rate by an order of magnitude. The most stable conditions (i.e. conditions under which a mineral is least reactive) for nepheline are in the pH range $5 \leqq pH \leqq 7$, and in highly saline aqueous solutions.

14499 Isotope geochemistry of fluid inclusions in Permian halite with implications for the isotopic history of ocean water and the origin of saline formation waters. Knauth, L.P.; Beeunas, M.A. (Arizona State Univ., Tempe). *Geochimica et Cosmochimica Acta;* **50**: No. 3, 419-433(Mar 1986).

As part of an investigation of the origin of water in the Permian-aged salt deposits of the Palo Duro Basin, Texas, they have analyzed $^{18}O/^{16}O$ and D/H ratio variations in water extracted from fluid inclusions in halite. The origin of water in these bedded salt deposits is important because certain horizons are under investigation for suitability as a repository site for high level nuclear waste. The fluid inclusion water could represent connate water which was trapped in the salt from the time of deposition and early diagenesis, or it could be subsurface water which penetrated the salt at a much later date. The implications of these two origins for the suitability and/or design of a nuclear waste repository are very different.

14500 Distribution of boron in the Tip Top pegmatite, Black Hills, South Dakota. Shearer, C.K.; Papike, J.J. (South Dakota School of Mines and Technology, Rapid City). *Geology;* **14**: No. 2, 119-123(Feb 1986). Contract FG01-84ER13259.

Experimental evidence has shown the importance of boron on the crystallization behavior of granitic systems; however, the intercrystalline and intracrystalline distribution of boron in mineral phases crystallizing from granitic systems is not well documented. The distribution of boron between coexisting phases in the Tip Top pegmatite, South Dakota, is as follows: beryl ca = quartz ca = triphylite ca = montebrasite ca = potassium feldspar < biotite < albite < muscovite < spodumene << tourmaline. The bulk boron content of the Tip Top pegmatite decreases significantly with the termination of tourmaline crystallization. The significant decrease in boron in the inner zones of the pegmatite is consistent with the depletion of boron in the granite melt by either the crystallization of tourmaline from the granitic melt or the partitioning of boron into an exsolved aqueous solutions. 35 references.

5805 Oceanography

REFER ALSO TO CITATION(S) 13297, 14353, 14360, 14382

14501 (NP—7770055) Water mass spreading in the warm water sphere of the eastern subtropical North Atlantic. Stramma, L. (Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde; Kiel Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 1984. 118p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE87770055.

Geostrophic transports in the eastern subtropical North Atlantic computed from historic hydrographic data and recent CTD measurements show a mean transport in the subtropical gyre of 11(+-1.6) x 10/sup 6/m/sup 3/s/sup -1/ in the upper 1000 m between 35/sup 0/W and the African coast. The dynamic method was used in conjunction with a conservation of mass scheme to determine the level of no motion. This level lies at the 1200 m depth near the Azores and drops to 1500 m in the tropics. The main inflow enters south of the Azores as a relatively narrow current, turns southward at the latitude of Madeira and then widens. Three current bands transport the water southward. North of the Cape Verde Islands, the current turns westwards. This part of the North Equatorial Current extends more to the south in the upper 200 m than in the 200-800 m layer. The Portugal current, between the Azores and the Portuguese coast, which is thought by some authors to be strong, is seen here as a relatively weak flow. Maps of potential vorticity derived from smoothed density profiles are consistent with the general pattern of geostrophic transport. At 24/sup 0/N one third of the total geostrophic southward transport of the recirculation and one third of the temperature flux is transported in the eastern Atlantic east of 35/sup 0/W.

64 PHYSICS I

14502 (DOE/ER/40200—054) The frontiers of physics (the next 25 years). Ne'eman, Y. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). 1986. Contract FG05-85ER40200. 12p. (TAUP/P—48). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004329.

Advances on both the small (quantum world) and large (cosmological) frontiers throughout this century are reviewed plausible targets for the next 25 years for physics research are presented.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 13876, 14147, 14148, 14209, 14571, 14623, 14651

14503 (AD-A—173964/8/XAB) Space-station microwave facility. Memorandum report. Weiler, K.W.; Dennison, B.K.; Bevilacqua, R.M.; Spencer, J.H.; Johnston, K.J. (Naval Research Lab., Washington, DC (USA)). 19 Sep 1986. 78p. (NRL-MR—5821). NTIS, PC A05/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

A large millimeter-wavelength interferometer array is proposed for construction on the planned Space Station (The Space Station Microwave facility-SSMF). It will have manifold applications in both basic and applied research and will be the premier instrument in the world at high radio frequencies. All weather target detection and identification, earth resource mapping, middle atmospheric studies, ionospheric research, atmospheric infrared-background investigations, interplanetary communications, and high-frequency radio astronomy are only a few of the areas which will be significantly advanced by the availability of such an instrument. Particularly in astronomy, the ability to do observations above the disturbing and absorbing effects of the Earth's atmosphere will allow new opportunities for exploration of all objects from the Sun, through the Solar System bodies, to the interstellar medium of the Milky Way and other galaxies, out to the most-distant quasars with resolution and sensitivity equalling or exceeding all existing or planned millimeter-wavelength telescopes.

14504 **(AD-A—174219/6/XAB) Final report on Contract N00014-78-C-0306. Final report.** (Control Data Corp., Minneapolis, MN (USA)). 1986. 29p. NTIS, PC A03/MF A01.

This reports consists, mainly, of reprints of scientific papers prepared under this contract. Titles include: Evidence for a solar-cycle signal in troposheric winds; Apparent solar-cycle influence on long-period oscillations in stratospheric zonal wind speed; and Proposed mechanism to explain a semi-annual variation in the winds in the polar mesosphere. Corrections and comments on related subjects are also included.

14505 **(AD-A—174508/2/XAB) Geomagnetic activity and north-south asymmetry of cosmic rays circa 1 GV. Final report, 1 March 1977-30 September 1984.** Ely, J.T.; Huang, T.C. (Washington Univ., Seattle (USA). Space Sciences Div.). 26 Sep 1986. 9p. NTIS, PC A02/MF A01.

Various features of solar-sector synchronous modulations of the particulate cosmic radiation reaching the earth's atmosphere have been studied using satellite and surface data. The flux in the broad maximum of the galactic cosmic-ray differential spectrum (near 1 GV rigidity) exhibits an intermittent north-south asymmetry in mid and high geomagnetic latitudes. This modulation exhibited a strong association with the geomagnetic disturbance index and interplanetary magnetic field direction during the 1964 and 1965 years of sunspot minimum. Such correlations are consistent with the predictions of a theory that attributes the north south asymmetry to reconnection of the interplanetary and geomagnetic fields. This finding is also consistent with suggestions that the solar-activity influence on atmospheric processes may be mediated by the resulting modulations of upper tropospheric ionization.

14506 **(BNL—38786) The nuclear equation of state.** Kahana, S. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 26p. (CONF-8609163—7). NTIS, PC A03/MF A01. File Number DE87002393.

From International conference and symposia on unified concepts of many-body problems; Stony Brook, NY, USA (4 Sep 1986).

The role of the nuclear equation of state in determining the fate of the collapsing cores of massive stars is examined in light of both recent theoretical advances in this subject and recent experimental measurements with relativistic heavy ions. The difficulties existing in attempts to bring the softer nuclear matter apparently required by the theory of Type II supernovae into consonance with the heavy ion data are discussed. Relativistic mean field theory is introduced as a candidate for derivation of the equation of state, and a simple form for the saturation compressibility is obtained. 28 refs., 4 figs., 1 tab.

14507 **(BNL—38863) White dwarf models of supernovae and cataclysmic variables.** Nomoto, K.; Hashimoto, M. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 10p. (CONF-8606204—2). NTIS, PC A02. File Number DE87004172.

From International Astronomical Union colloquium; Bamberg, F.R. Germany (16 Jun 1986).

If the accreting white dwarf increases its mass to the Chandrasekhar mass, it will either explode as a Type I supernova or collapse to form a neutron star. In fact, there is a good agreement between the exploding white dwarf model for Type I supernovae and observations. We describe various types of evolution of accreting white dwarfs as a function of binary parameters (i.e,. composition, mass, and age of the white dwarf, its companion star, and mass accretion rate), and discuss the conditions for the precursors of exploding or collapsing white dwarfs, and their relevance to cataclysmic variables. Particular attention is given to helium star cataclysmics which might be the precursors of some Type I supernovae or ultrashort period x-ray binaries. Finally we present new evolutionary calculations using the updated nuclear reaction rates for the formation of O+Ne+Mg white dwarfs, and discuss the composition structure and their relevance to the model for neon novae. 61 refs., 14 figs.

14508 **(CONF-8602110—2) The hydrogen coverage of interstellar PAHs [Polycyclic Aromatic Hydrocarbons].** Tielens, A.G.G.M.; Allamandola, L.J.; Barker, J.R.; Cohen, M. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center; Michigan Univ., Ann Arbor (USA). Dept. of Atmospheric and Oceanic Science; California Univ., Berkeley (USA). Radio Astronomy Lab.). Feb 1986. Contract FG02-85ER13442. 13p. NTIS, PC A02/MF A01. File Number DE87003376.

From Conference on polycyclic aromatic hydrocarbons and astrophysics; Les Houches, France (1 Feb 1986).

The rate at which the CH bond in interstellar Polycyclic Aromatic Hydrocarbons (PAHs) rupture due to the absorption of a uv photon has been calculated. The results show that small PAHs (less than or equal to 25 carbon atoms) are expected to be partially dehydrogenated in regions with intense uv fields, while large PAHs (greater than or equal to 25 atoms) are expected to be completely hydrogenated in those regions. Because estimate of the carbon content of interstellar PAHs lie in the range of 20 to 25 carbon atoms, dehydrogenation is probably not very important. Because of the absence of other emission features besides the 11.3 micrometer feature in ground-based 8 to 13 micrometer spectra, it has been suggested that interstellar PAHs are partially dehydrogenated. However, IRAS 8 to 22 micrometer spectra of most sources that show strong 7.7 and 11.2 micrometer emission features also show a plateau of emission extending from about 11.3 to 14 micrometer. Like the 11.3 micrometer feature, this new feature is attributed to the CH out of plane bending mode in PAHs. This new feature shows that interstellar PAHs are not as dehydrogenated as estimated from ground-based 8 to 13 micrometer spectra. It also constrains the molecular structure of interstellar PAHs. In particular, it seems that very condensed PAHs, such as coronene and circumcoronene, dominate the interstellar PAH mixture as expected from stability arguments.

14509 (JINR—R-2-85-667, pp 5-11) **State of the experiment on radiation and detection of gravitational waves in laboratory conditions.** Akishin, P.G.; Basha, S.G.; Bogolyubov, P.N. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

State of experiment on radiation and detection of gravitational waves in laboratory is analysed. To develop a laboratory emitter and detector, an idea of coherent energy conversion between waves of different physical nature interacting nonlinearly with material medium is discussed. Waves can intensively exchange their energy as well as to transfer it to gravitational wave. Density matrix method was used as a mathematical basis for analysis of nonlinear wave interaction. Perspectivity of a chosen direction of investigations was shown. 7 refs.; 4 figs.

14510 (JINR—R-2-85-667, pp 12-18) **Elaboration of a vibration-protective foundation for the gravitation installation.** Vasilenko, A.T.; Solov'eva, G.M. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

An antiseismic platform has been developed within the framework of theme of investigation into problem of gravitational interactions. The platform is established on sandy soil on ten supporting stands. Each stand consists of three duralumin sheets between which two microporous rubber layers are placed.There is a layer of timbers on supporting stands. Concrete parallepiped of 52.3m mass is placed on timbers. There are polyethylene and three dralumin plates on the horizontal plane of block. The platform structure represents a two-section filter: rubber gaskets and concrete unit are the first section, plyethylene gaskets and duralumin plate - the second section. Eigenfrequency for the first filter link amounts to 4 Hz, for the second link - 16.3 Hz.

14511 (JINR—R-2-85-667, pp 16-18) **On a foundation for a gravitational wave installation.** Kolosnitsyn, N.I.; Patrugin, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Vibration foundation for a gravitational-wave installation is suggested. the foundation includes two stages - two oscillators connected with each other with respect of coordinate and velocity. Equations of motion of these double system have been derived and solved. Results of calculation of suppression coefficient for seismic oscillations are given. High Q-factors of the two oscillators provide improved noise immunity at high frequencies.

14512 (JINR—R-2-85-667, pp 29-37) **On gravitational wave detection by means of resonance multiwave parametric processes.** Uzhinskij, V.V. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Equations describing interaction of gravitational and electromagnetic waves in medium having non-linear susceptibility are analyzed mathematically. Explicit solutions of equations which amplitudes of electromagnetic pumping waves obey are presented. Amplitude growth of a signal electromagnetic wave not assigned from outside but initiated under interaction of gravitational and electromagnetic waves is shown to be limited by depletion of pumping. Utilization of collinear and noncollinear waves is analyzed. The latter is shown to have some merit due to freedom of choice of boundary conditions.

14513 (JINR—R-2-85-667, pp 38-44) **Effect of coherent emission impulse structure on stability of expectation output of gravitational waves from monocrystal.** Pisarenko, G.S.; Leonets, V.A.; Pisarenko, V.G. (AN Ukrainskoj SSR, Kiev. Inst. Problem Prochnosti; AN Ukrainskoj SSR, Kiev. Inst. Geofiziki). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Problem of engineering realization of idea of gravitational wave excitation in solid by its irradiation with two coherent plane electromagnetic waves is studied. During crystal laser irradiation heterogeneity of its heating is observed. Crystal deformation due to heating heterogeneity results in increase of optical wave path. In case of K-8 glass leading plane-wave front is considerably distorted. This makes it difficult to use that glass as a material for manufacturing a working body of a gravitational wave generator.

14514 (JINR—R-2-85-667, pp 45-49) **On a possibility of gravitational wave detection in the superhigh frequency range by means of a laser-interferometric receiver.** Alekseev, A.D.; Kolosnitsyn, N.I. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Possibility for using laser-interferometric method to record gravitational radiation is discussed. Peculiarity of laser-interferometric receivers of gravitational radiation is their selective sensitivity in certain frequency ranges named gravitational-optical resonances. During recording of high-frequency gravitational radiation the laser-interferometric receiver must operate at the first resonance. Problem of recording of gravitational radiation with frequency ν=10/sup 9/ Hz was considered. Minimal recorded radiation flux constitutes I approximately 1.22 x 10/sup 15/ erg/cm/sup 2/xs. To produce such radiation flux, it is necessary to have a source of power exceeding P=3.35 x 10/sup 10/.

14515 (JINR—R-2-85-667, pp 50-54) **On a choice of an optimum scheme and parameters of laser-interferometric gravitational wave antenna.** Alekseev, A.D.; Kolosnitsyn, N.I. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Efficiency of laser-interferometric gravitational wave antenna was analysed. Frequency characteristics of antenna with optical delay lines and the Fabry-Perot resonators are given. Sensitivity of antenna with the Fabry-Perot resonator near zero is considerably higher than sensitivity of antenna with delay lines (approximately 300 times). However this difference diminishes quickly with frequency growth. Beginning approximately from a frequency ν=200 Hz antenna sensitivity with delay lines turns out to be higher as compared with antenna with the Fabry-Perot resonator. In the frequency range of about 1.5 kHz sensitivity of antenna with delay line is about two times higher in comparison with antenna with the Fabry-Perot resonator.

14516 (JINR—R-2-85-667, pp 55-60) **On some types of noises of the laser-interferometric gravitational antenna.** Vitushkin, L.F.; Kazakov, A.Ya. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Problem related to improvement of laser-interferometric gravitational antenna (LIGA) sensitivity is discussed. Phenomena playing a role of noises in LIGA were considered. It is shown that at pressures lower than 10/sup -5/-10/sup -6/ mm Hg amplitude of fluctuations of optical ray path value can be reduced to values lower than 10/sup -15/ cm using signal filtration.

14517 (JINR—R-2-85-667, pp 61-64) **Optical resonator in the gravitational wave field.** Vitushkin, L.F.; Razumovskij, N.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Perturbation of natural osillations of an electromagnetic resonator by a gravitational wave is considered. A possibility of resonance accumulation of perturbation is studied. Absence of accumulation of a rotation angle of the light polarization plane in an optical resonator is stated, in particular.

14518 (JINR—R-2-85-667, pp 65-73) **Quantum model of the laser-interferometric gravitational antenna.** Vitushkin, L.F.; Smirnov, M.Z. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

A quantum model of laser-interferometric gravitational antenna (LIGA) considering natural fluctuations of laser radiation is suggested. A body of mathematics permitting to calculate change of quantum statistical properties of radiation when passing through laser interferometer is formulated. Interferometer resolution is limited with shot and wave fluctuations of photocurrent approximately to the same degree. It is shown that there is a possibility of principle for suppression of these noises when using optical radiation in pinched quantum state.

14519 (JINR—R-2-85-667, pp 74-77) **Gravitational wave detector on the basis of light diffraction.** Segizboev, T.I.; Uzhinskij, V.V. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

A method for detection of gravitational waves by means of light diffraction at the first maximum on oscillations in optically transparent matter under effect of gravitational waves is considered. Intensity of light flux scattering on oscillations of elastic rod is calculated. A possibility of using the diffraction method for detection of gravitational waves is disclosed.

14520 (JINR—R-2-85-667, pp 78-83) **Quantum biological gravitational wave detectors.** Kopvillem, U.Kh. (AN SSSR, Vladivostok. Dal'nevostochnyj Nauchnyj Tsentr). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

A possibility of producing biological detectors of gravitational waves is considered. High sensitivity of biological systems to outer effects can be ensured by existence of molecule subgroups in Dicke states. Existence of clusters in Dicke state-giant electric dipoles (GED) is supposed in the Froehlich theory. Comparison of biological and physical detectors shows that GED systems have unique properties for detection of gravitational waves if the reception range is narrow.

14521 (JINR—R-2-85-667, pp 92-110) **On quantum limits for an indication system of the gravitational wave detector.** Menskij, M.B. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

The method of integration by paths is applied for estimation of quantum restrictions on sensitivity of Weber type gravitational detector. Indication systems tracing oscillations of the Weber resonator are considered. Way of describing evolution of the quantum system under continuous measurement is shown and the requirement of unitarity is generalized for this case. Two regimes of continuous measurement of a harmonic oscillator (tracing the coordinate and spectral mesurements) are calculated and estimations for sensitivity of a gravitational antenna of Weber type are obtained. A system of bound oscillators, i.e. the case when the indication system includes the oscillating circuit, the quantum properties of which cannot be neglected, is considered.

14522 (JINR—R-2-85-667, pp 111-118) **Measurement of gravitational field small variations by means of an optical laser interferometer in the Earth gravitational field.** Borisova, L.B.; Mel'nikov, V.N. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

The problem of using an optical laser interferometer for detection of small variations of a gravitational field is discussed. The idea of detection is based on measuring variation of an interference picture conditioned by effect of gravitational field on the interferometer. Effect of the gravitational field on light beams and on mirrors reflecting them should be taken into account when studying behaviour of the laser interferometer in the gravitational field.

14523 (LA-UR—86-3907) **Dust-gas interaction deduced from Halley multicolour camera observations.** Huebner, W.F.; Delamere, W.A.; Keller, H.U.; Reitsema, H.J.; Schmidt, H.U.; Whipple, F.L.; Wilhelm, K. (Los Alamos National Lab., NM (USA); Ball Aerospace Systems Div., Boulder, CO (USA); Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.); Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik; Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8610207—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003426.

From 20. ESLAB symposium; Heidelberg, F.R. Germany (27 Oct 1986).

The dust and gas productions of Comet Halley were measured by the dust counter and the mass spectrometers on the Giotto spacecraft. These instruments give only little information about the spatial asymmetry of the activity. The asymmetry in the dust production is clearly evident from the dust jets seen in the Halley Multicolour Camera images. Since the dust is entrained by the gas, production must be similarly asymmetric. The intensity profiles along and across several dust jets are related to their source regions on the nucleus. Properties of the dust jets are investigated. A few compact, but highly active source regions on the nucleus produce most of the visible dust and can account for most of the gas produced by the comet. 2 refs.

14524 (LA-UR—86-3908) **Model ion abundances for comet Halley.** Huebner, W.F.; Boice, D.C.; Keady, J.J.; Schmidt, H.U.; Wegman, R. (Los Alamos National Lab., NM (USA); Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik). 27 Oct 1986. Contract W-7405-ENG-36. 1986p. (CONF-8610207—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003710.

From 20. ESLAB symposium; Heidelberg, F.R. Germany (27 Oct 1986).

A computer model for comet comae has been applied to predict ion abundances for comet Halley. It is assumed that the volatile component of the nucleus is 85% water and that the remaining volatile molecules are composed of carbon, nitrogen, oxygen, and sulfur. Model parameters such as heliocentric distance, size, and albedo are chosen to be consistent with the 13-14 March 1986 encounter of the Giotto spacecraft with the comet. Photoprocesses, gas-phase chemical kinetics, coma energy balance including a separate electron temperature, multifluid hydrodynamics with a transition to free molecular flow, fast streaming atomic and molecular hydrogen, and counter and cross streaming of species in the coma-solar wind interaction are taken into consideration. A comparison of the model results is made with preliminary data from the ion mass spectrometer at 6000 and 1500 km from the nucleus. We find good overall agreement. The implication of the coma physics and chemistry are discussed. 2 tabs.

14525 (LA-UR—86-3942) **The comet Giacobini-Zinner magnetotail: Axial stresses and inferred near-nucleus properties.** McComas, D.J.; Gosling, J.T.; Bame, S.J.; Slavin, J.A.; Smith, E.J.; Steinberg, J.L. (Los Alamos National Lab., NM (USA); Jet Propulsion Lab., Pasadena, CA (USA); Observatoire de Paris, Section de Meudon, 92 (France)). Oct 1986. Contract W-7405-ENG-36. 5p. (CONF-8610207—4). NTIS, PC A02/MF A01. File Number DE87003712.

From 20. ESLAB symposium; Heidelberg, F.R. Germany (27 Oct 1986).

Utilizing the electron and magnetic field data from the ICE tail traversal of Comet Giacobini-Zinner along with the MHD equations, we have developed a steady state, stress balance model of the cometary magnetotail. With it we infer many important but unmeasured ion properties within the G-Z magnetotail both at ICE and upstream at the average point along each streamline where cometary ions are picked-up. The derived tailward ion flow speed at ICE is quite constant at ~-20 to -30 km/sec across the entire tail. The flow velocity, ion temperature, density, and ion source rates upstream from the lobes (current sheet) at the average pickup locations are ~-75 km/sec (~-12), ~4 x 10^6 K (~1 x 10^5), ~20 / cm^3 (~400), and ~.15 /cm^3/sec (~3.6). Gradients in the plasma properties between these two regions are quire strong. Implications of our inferred plasma properties for the near-nucleus region and for cometary magnetotail formation are examined. 9 refs., 1 fig.

14526 (LA-UR—86-4109) **An asteroseismology explorer.** Brown, T.M.; Cox, A.N. (Los Alamos National Lab., NM (USA); High Altitude Observatory, Boulder, CO (USA)). 11 Aug 1986. Contract W-7405-ENG-36. 5p. (CONF-8608130—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003716.

From Stellar pulsation conference; Los Alamos, NM, USA (11 Aug 1986).

In response to a NASA opportunity, a proposal has been made to study the concept of an Asteroseismology Explorer (ASE).

The goal of the ASE would be to measure solar-like oscillations on many (perhaps hundreds) of stars during a 1-year mission, including many members of open clusters. We describe this proposal's observational goals, a strawman technical approach, and likely scientific rewards. 5 refs.

14527 (LA-UR—86-4110) Pulsations of B stars: A review of observations and theories. Cox, A.N. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-8608130—8). NTIS, PC A02/MF A01. File Number DE87003717.

From Stellar pulsation conference; Los Alamos, NM, USA (11 Aug 1986).

The observational and theoretical status are discussed for several classes of variable B stars. The older classes now seem to be better understood in terms of those stars that probably have at least one radial mode and those that have only nonradial modes. The former are the β Cephei variables, and the latter are the slowly rotating 53 Persei and the rapidly rotating zeta Ophiuchi variables. It seems that in this last class there are also some Be stars that show nonradial pulsations from the variations of the line shapes and their light. Among the nonradial pulsators, we must also include the supergiants which show pulsations with very short lifetimes. A review of the present observational and theoretical problems is given. The most persistent problem of the cause for the pulsations is briefly discussed, and many proposed mechanisms plus some new thoughts are presented. 57 refs., 4 figs.

14528 (LA-UR—86-4111) Nonradial pulsations of delta Scuti stars. King, D.S.; Cox, A.N. (Los Alamos National Lab., NM (USA); New Mexico Univ., Albuquerque (USA)). 11 Aug 1986. Contract W-7405-ENG-36. 5p. (CONF-8608130—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003718.

From Stellar pulsation conference; Los Alamos, NM, USA (11 Aug 1986).

An improved stellar model with a detailed composition structure is used to look at the nonradial behavior of a star near the region in the H-R diagram where the delta Scuti variables are found. Satisfactory solutions are obtained to the linear nonadiabatic equations. The newly calculated evolution models will be used in the future to study the pulsational stability of this class of stars. 4 refs., 2 figs., 1 tab.

14529 (LA-UR—86-4112) Nonlinear pulsations of luminous He stars. Proffitt, C.R.; Cox, A.N. (Los Alamos National Lab., NM (USA); Washington Univ., Seattle (USA). Dept. of Astronomy). 11 Aug 1986. Contract W-7405-ENG-36. 5p. (CONF-8608130—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003719.

From Stellar pulsation conference; Los Alamos, NM, USA (11 Aug 1986).

Radial pulsations in models of R Cor Bor stars and BD + 1°4381 have been studied with a nonlinear hydrodynamic pulsation code. Comparisons are made with previous calculations and with observed light and velocity curves. 13 refs., 2 tabs.

14530 (LA-UR—86-4157) Positron annihilation in the Galactic Center: "Cheshire cat" Compton scattering and "excess continuum". Bildsten, M.L.; Zurek, W.H. (Los Alamos National Lab., NM (USA); Cornell Univ., Ithaca, NY (USA). Dept. of Physics). 1986. Contract W-7405-ENG-36. 5p. (CONF-8610211—1). NTIS, PC A02/MF A01. File Number DE87003729.

From Galactic Center conference; Berkeley, CA, USA (25 Oct 1986).

Two separate observations of the γ-ray spectrum originating from the Galactic Center were made by HEAO-3 in the fall of 1979 and in the spring of 1980. The 2γ 511 KeV annihilation line flux decreased by a factor of three over the corresponding six month period, whereas the excess γ-ray continuum below the 511 KeV line, often interpreted as 3γ decay of orthopositronium, barely changed. This apparent discrepancy in the temporal behavior makes it difficult to associate the bulk of the excess continuum with the 3γ decay of positronium. We will show that Compton scattering of the line and high energy radiation provides a natural explanation for the surprisingly small change seen in the excess continuum. 11 refs., 2 figs.

14531 (LA-UR—86-4196) Nonadiabatic, nonradial solar oscillations. Kidman, R.B.; Cox, A.N. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8608130—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003736.

From Stellar pulsation conference; Los Alamos, NM, USA (11 Aug 1986).

Solar gravity mode (g-mode) oscillations are not easy to detect and identify because their surface amplitudes are very small. However, since their largest amplitudes occur in the deep interior of the sun, their correct interpretation could be invaluable in unraveling the interior structure of the sun. Toward this end, some nonadiabatic, nonradial solar g-mode calculations, using the Lagrangian-based eigensolution program of Pesnell, are presented. 2 figs., 2 tabs.

14532 (LA-UR—86-4362) The P/Giacobini-Zinner magnetotail. Slavin, J.A.; Smith, E.J.; Daly, P.W.; Flammer, K.R.; Gloeckler, G.; Goldberg, B.A.; McComas, D.J.; Scarf, F.L.; Steinberg, J.L. (Los Alamos National Lab., NM (USA); Jet Propulsion Lab., Pasadena, CA (USA); Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (Germany, F.R.); California Univ., San Diego, La Jolla (USA); Maryland Univ., College Park (USA); TRW Space and Technology Group, Redondo Beach, CA (USA)). 1986. Contract W-7405-ENG-36. 8p. (CONF-8610207—1). NTIS, PC A02. File Number DE87003761.

From 20. ESLAB symposium; Heidelberg, F.R. Germany (27 Oct 1986).

On September 11, 1985 the International Cometary Explorer passed behind Comet Giacobini-Zinner with a closest approach distance of 7800 km. In agreement with Alfven's interplanetary magnetic field line draping model of cometary type I tails, a well defined 1×10^4 km diameter magnetotail was observed downstream of the inner coma. This study uses the ICE magnetic field, plasma electron, plasma wave, and energetic ion observations to investigate the structure and stability of the Giacobini-Zinner magnetic tail. Emphasis is placed on the identification of differences and similarities between cometary and planetary magnetotails. Finally, the ICE magnetotail observations are discussed in relation to the global solar wind interaction with P/Giacobini-Zinner. 33 refs., 8 figs.

14533 (MPE-PREPRINT—2) Disappearance of periodic x-ray minima in AM Her. Priedhorsky, W.; Marshall, F.J.; Hearn, D.R. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.)). Apr 1986. 22p. (ETN—86-98212). Issuing Activity.

Optical, soft x-ray, and medium energy x-ray measurements taken during an unusual high state of AM Her are reported. The x-ray and secondary optical minima disappeared from the light curve. The x-ray flux varied periodically. In each x-ray band, the flux during the expected phase of minimum was approximately the same as the average during the rest of the cycle. The optical and medium energy x-ray fluxes were at all-time highs; however, the soft x-ray flux was low by a factor of 3 compared to the nominal high state. This change in the ratio of medium to soft x-ray flux is difficult to fit into the standard scenario for AM Her, where soft x-rays are interpreted as reprocessed optical and medium energy x-ray flux. The peculiar light curve of AM Her was probably caused by a small shift in the position of the accretion column with respect to the rotation axis, so that the normal grazing eclipse of the accretion column did not take place.

14534 (MPE-PREPRINT—5) Bimodal quasi-oscillatory and spectral behavior in Sco X-1. Priedhorsky, W.; Hasinger, G.; Lewin, W.H.G.; Middleditch, J.; Parmar, A.; Stella, L.; White, N. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.)). Jan 1985. 18p. (ETN—86-98264). Issuing Activity.

X-ray observations were made to follow up the discovery of quasi-periodic oscillations (QPO) in Sco X-1. The QPO is observed in the quiescent state, and between flares in the active state. When

the source is quiescent, the QPO frequency is 6 Hz and anticorrelated with intensity; in the active state, the frequency ranges from 10 to 20 Hz and is strongly correlated with intensity. At high intensities the QPO dissolves into continuum noise. The QPO rms amplitude decreases with count rate, and increases with photon energy. There are two modes of spectral behavior, with a one-to-one correspondence to the two modes of QPO: the spectral hardness ratio varies more steeply with intensity when the source shows 6 Hz QPO, than for 10 to 20 Hz QPO. Transitions between QPO modes, which occur when the flux is at its lowest levels, correspond to transitions between hardness ratio modes. The QPO frequency changes continuously through the transitions, which last a few hundred seconds.

14535 (N—86-32348) **Workshop on Cosmogenic Nuclides.** Reedy, R.C.; Englert, P. (Lunar and Planetary Inst., Houston, TX (USA)). 1986. 82p. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.). NTIS HC A05/MF A01.

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Abstracts of papers presented at the Workshop on Cosmogenic Nuclides are compiled. The major topic areas covered include: new techniques for measuring nuclides such as tandem accelerator and resonance mass spectrometry; solar modulation of cosmic rays; pre-irradiation histories of extraterrestrial materials; terrestrial studies; simulations and cross sections; nuclide production rate calculations; and meteoritic nuclides.

14536 (N—86-32348, pp vp) **Nuclide production in (very) small meteorites.** Arnold, J.R.; Nishiizumi, K. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

One of the most interesting open questions in the study of cosmic-ray effects in meteorites is the expected behavior of objects which are very small compared to the mean interaction length of primary galactic cosmic ray (GCR) particles. A reasonable limit might be a pre-atmospheric radius of 5 gram/cm(2), or 1.5 cm for chondrites. These are interesting for at least three reasons: (1) this is a limiting case for large objects, and can help us make better models; (2) this size is intermediate between usual meteorites and irradiated grams (spherules); and (3) these are the most likely objects to show solar cosmic ray (SCR) effects. Reedy (1984) has recently proposed a model for production by GCR of radioactive and stable nuclides in spherical meteorites. Very small objects are expected to deviate from this model in the direction of fewer secondary particles (larger spectral shape parameter), at all depths. The net effect will be significantly lower production of such low-energy products as Mn-53 and Al-26. The SCR production of these and other nuclides will be lower, too, because meteorite orbits extend typically out into the asteroid belt, and the mean SCR flux must fall off approximately as r(-2) with distance from the Sun. Kepler's laws insure that for such orbits most of the exposure time is spent near aphelion. None the less the equivalent mean exposure distance, R(exp), is slightly less than the semimajor axis A because of the weighting by R(-2). For the three meteorite orbits we have, R(exp) has a narrow range, from about 1.6 to 2.1 a.u. This is probably true for the great majority of meteorites.

14537 (N—86-32348, pp vp) **Simulation experiments for gamma-ray mapping of planetary surfaces: scattering of high-energy neutrons.** Brueckner, J.; Englert, P.; Reedy, R.C.; Waenke, H. (Cologne Univ., West Germany; Los Alamos National Lab., NM). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

The concentration and distribution of certain elements in surface layers of planetary objects specify constraints on models of their origin and evolution. This information can be obtained by means of remote sensing gamma-ray spectroscopy, as planned for a number of future space missions, i.e., Mars, Moon, asteroids, and comets. To investigate the gamma-rays made by interactions of neutrons with matter, thin targets of different composition were placed between a neutron-source and a high-resolution germanium spectrometer. Gamma-rays in the range of 0.1 to 8 MeV were accumulated. In one set of experiments a 14-MeV neutron generator using the T(d,n) reaction as neutron-source was placed in a small room. Scattering in surrounding walls produced a spectrum of neutron energies from 14 MeV down to thermal. This complex neutron-source induced mainly neutron-capture lines and only a few scattering lines. As a result of the set-up, there was a considerable background of discrete lines from surrounding materials. A similar situation exists under planetary exploration conditions: gamma-rays are induced in the planetary surface as well as in the spacecraft. To investigate the contribution of neutrons with higher energies, an experiment for the measurement of prompt gamma radiation was set up at the end of a beam-line of an isochronous cyclotron.

14538 (N—86-32348, pp vp) **Precompaction irradiation effects: Particles from an early active sun?.** Caffee, M.W.; Goswami, J.N.; Hohenberg, C.M.; Swindle, T.D. (Physical Research Lab., Ahmedabad, India). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Two recent studies have shown that solar flare irradiated grains from Murchison and Kapoeta have excess spallogenic Ne-21 compared to unirradiated grains, indicating large precompaction particle irradiation effects. The quantity of cosmogenic neon in these grains presents serious difficulties for either galactic cosmic ray or normal solar flare sources. In the first study it was suggested that the effect might be the result of exposure to an early active sun. The more recent experiment both confirms the earlier results and provides constraints on the characteristic energy spectrum on the irradiation. The first results were obtained from Murchison olivines and Kapoeta pyroxenes by mass spectrometric analysis of sets of grains selected on the basis of the presence or absence of solar flare particle tracks. In the second work plagioclase feldspar grains from Kapoeta were studied.

14539 (N—86-32348, pp vp) **Solar modulation of galactic cosmic rays: contemporary observations and theories.** Forman, M.A. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

The flux of galactic cosmic rays inside the solar system is modulated by the action of the complex magnetic fields carried from the Sun by the solar wind. This is apparent from the recurrent decrease of about 20% in the intensity of relativistic cosmic rays during sunspot maximum compared to sunspot minimum, from transient decreases due to solar flares and many other more subtle effects observed by ground stations for the last 50 years. Spacecraft observations of the spatial and temporal variations of cosmic ray flux during the last ten years have shown that the solar wind and cosmic-ray modulation extend to at least 30 astronomical units in the ecliptic plane. Present best guesses are that it goes out to 100 or 200 AU, perhaps less over the poles. Theories describing the mechanism of solar modulation are outlined and the importance of having a firm understanding of this mechanism to the study of other astrophysical phenomena is discussed.

14540 (N—86-32348, pp vp) **Evolution of gas-rich meteorites: clues from cosmogenic nuclides.** Goswami, J.N. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

The evolution of gas-rich meteorites in general, and the setting in which the observed solar-wind, solar-flare irradiation records were imprinted in individual components of these meteorites are understood only in qualitative terms, although contrary viewpoints do exist. The regolith irradiation hypothesis, bolstered by the observations of irradiation features in lunar regolith materials, similar to those observed in gas-rich meteorites, is accepted by many workers in this field. However, a close analysis of the problem suggests that the regolith irradiation may not be the dominant

mode in producing the observed precompaction irradiation features in the gas-rich meteorites.

14541 (N—86-32348, pp vp) **Exposure history of Jilin and production rates of cosmogenic nuclides.** Heusser, G. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Jilin, the largest known stony meteorite, is a very suitable object for studying the systematics of cosmic ray produced nuclides in stony meteorites. Its well established two stage exposure history even permits to gain information about two different irradiation geometries (2pi and 4pi). All stable and long-lived cosmogenic nuclides measured in Jilin so far correlate well with each other. An example is shown where the Al-26 activities are plotted vs. the spallogenic Ne-21 concentration. These records of cosmic-ray interaction in Jilin can be used both to determine the history of the target and to study the nature of production rate profiles. This is unavoidably a bootstrap process, involving studying one with assumption about the other. Production rate equations are presented and discussed.

14542 (N—86-32348, pp vp) **Radionuclide measurements by accelerator mass spectrometry at Arizona.** Jull, A.J.T.; Donahue, D.J.; Zabel, T.H. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Over the past years, Tandem Accelerator Mass Spectrometry (TAMS) has become established as an important method for radionuclide analysis. In the Arizona system the accelerator is operated at a thermal voltage of 1.8MV for C-14 analysis, and 1.6 to 2MV for Be-10. Samples are inserted into a cesium sputter ion source in solid form. Negative ions sputtered from the target are accelerated to about 25kV, and the injection magnet selects ions of a particular mass. Ions of the 3+ charge state, having an energy of about 9MeV are selected by an electrostatic deflector, surviving ions pass through two magnets, where only ions of the desired mass-energy product are selected. The final detector is a combination ionization chamber to measure energy loss (and hence, Z), and a silicon surface-barrier detector which measures residual energy. After counting the trace isotope for a fixed time, the injected ions are switched to the major isotope used for normalization. These ions are deflected into a Faraday cup after the first high-energy magnet. Repeated measurements of the isotope ratio of both sample and standards results in a measurement of the concentration of the radionuclide. Recent improvements in sample preparation for C-14 make preparation of high-beam current graphite targets directly from CO_2 feasible. Except for some measurements of standards and backgrounds for Be-10 measurements to date have been on C-14. Although most results have been in archaeology and quaternary geology, studies have been expanded to include cosmogenic C-14 in meteorites. The data obtained so far tend to confirm the antiquity of Antarctic meteorites from the Allan Hills site. Data on three samples of Yamato meteorites gave terrestrial ages of between about 3 and 22 thousand years.

14543 (N—86-32348, pp vp) **Cosmic ray interactions in the ground: temporal variations in cosmic ray intensities and geophysical studies.** Lal, D. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Temporal variations in cosmic ray intensity have been deduced from observations of products of interactions of cosmic ray particles in the Moon, meteorites, and the Earth. Of particular interest is a comparison between the information based on Earth and that based on other samples. Differences are expected at least due to: (1) differences in the extent of cosmic ray modulation, and (2) changes in the geomagnetic dipole field. Any information on the global changes in the terrestrial cosmic ray intensity is therefore of importance. In this paper a possible technique for detecting changes in cosmic ray intensity is presented. The method involves human intervention and is applicable for the past 10,000 yrs. Studies of changes over longer periods of time are possible if supplementary data on age and history of the sample are available using other methods. Also discussed are the possibilities of studying certain geophysical processes, e.g., erosion, weathering, tectonic events based on studies of certain cosmic ray-produced isotopes for the past several million years.

14544 (N—86-32348, pp vp) **Production rates of neon xenon isotopes by energetic neutrons.** Leich, D.A.; Borg, R.J.; Lanier, V.B. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

As a first step in an experimental program to study the behavior of noble gases produced in situ in minerals, a suite of minerals and pure chemicals were irradiated with 14.5 MeV neutrons at LLNL's Rotating Target Neutron Source (RTNS-II) and production rates for noble gases were determined. While neutron effects in meteorites and lunar samples are dominated by low-energy neutron capture, more energetic cosmic-ray secondary neutrons can provide significant depth-dependent contributions to production of cosmogenic nuclides through endothermic reactions such as (n,2n), (n,np), (n,d) and (n,alpha). Production rates for nuclides produced by cosmic-ray secondary neutrons are therefore useful in interpreting shielding histories from the relative abundances of cosmogenic nuclides. Absolute production cross sections were calculated from isotope dilution analyses of NaCl, Mg, CsCl, and $Ba(NO_3)_2$ samples, assuming purity, stoichiometry, and quantitative noble gas retention and extraction. Relative production cross sections determined from neon isotopic ratios in the mineral samples were also considered in evaluating the neon production cross sections. Results are presented.

14545 (N—86-32348, pp vp) **Live ^{129}I-^{129}Xe dating.** Marti, K. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

A technique of cosmic ray exposure age dating using cosmic ray produced I-129 and Xe-129 components is discussed. The live I-129 - Xe-129 method provides an ideal monitor for cosmic ray flux variations on the 10(7)y - 10(8)y time-scale. It is based on low-energy neutron reactions on Te, and these data, when coupled to those from other methods, may facilitate the detection of complex exposure histories.

14546 (N—86-32348, pp vp) **Production of radionuclides in artificial meteorites irradiated isotropically with 600 MeV protons.** Michel, R.; Dragovitsch, P.; Englert, P.; Herpers, U. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

The understanding of the production of cosmogenic nuclides in small meteorites (R is less than 40 cm) still is not satisfactory. The existing models for the calculation of depth dependent production rates do not distinguish between the different types of nucleons reacting in a meteorite. They rather use general depth dependent particle fluxes to which cross sections have to be adjusted to fit the measured radionuclide concentrations. Some of these models can not even be extended to zero meteorite sizes without logical contradictions. Therefore, a series of three thick target irradiations was started at the 600 MeV proton beam of the CERN isochronuous cyclotron in order to study the interactions of small stony meteorites with galactic protons. The homogeneous 4 pi irradiation technique used provides a realistic meteorite model which allows a direct comparison of the measured depth profiles with those in real meteorites. Moreover, by the simultaneous measurement of thin target production cross sections one can differentiate between the contributions of primary and secondary nucleons over the entire volume of the artificial meteorite.

14547 (N—86-32348, pp vp) **Resonance ionization mass spectrometry for isotopic abundance measurements.** Miller, C.M. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Resonance ionization mass spectrometry (RIMS) is a relatively new laser-based technique for the determination of isotopic abundances. The resonance ionization process depends upon the stepwise absorption of photons from the laser, promoting atoms of the element of interest through progressively higher electronic states until an ion is formed. Sensitivity arises from the efficiency of the resonant absorption process when coupled with the power available from commercial laser sources. Selectivity derives naturally from the distinct electronic structure of different elements. This isobaric discrimination has provided the major impetus for development of the technique. Resonance ionization mass spectrometry was used for analysis of the isotopic abundances of the rare earth lutetium. Isobaric interferences from ytterbium severely effect the ability to measure small amounts of the neutron-deficient Lu isotopes by conventional mass spectrometric techniques. Resonance ionization for lutetium is performed using a continuous-wave laser operating at 452 nm, through a sequential two-photon process, with one photon exciting the intermediate resonance and the second photon causing ionization. Ion yields for microgram-sized quantities of lutetium lie between 10(6) and 10(7) ions per second, at overall ionization efficiencies approaching 10(-4). Discrimination factors against ytterbium greater than 10(6) have been measured. Resonance ionization for technetium is also being explored, again in response to an isobaric interference, molybdenum. Because of the relatively high ionization potential for Tc, three-photon, two-color RIMS processes are being developed.

14548 (N—86-32348, pp vp) **Compilation of cosmogenic radionuclides in meteorites.** Nishiizumi, K. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

All available data for the concentration of cosmogenic nuclides Mn-53(t(1/2) = 3.7 x 10(6) years), Al-26 (7.05 x 10(5) years), Be-10 (1.6 x 10(6) years), Cl-36 (3.0 x 10(5) years) and Ne-21, and Ne-22/Ne-21 ratios in stony, iron, and stony-iron meteorites were compiled. For iron meteorites, the He-4/Ne-21 ratio was adopted instead of Ne-22/Ne-21 ratio, because the He-4/Ne-21 ratio in iron meteorites indicates the shielding condition of the sample. The compilation contains over 2000 different analyses for four cosmogenic radionuclides.

14549 (N—86-32348, pp vp) **Redetermination of parameters for semi-empirical model for spallogenic He and Ne in chondrites.** Nyquist, L.E.; Mcdowell, A.F. (Lunar and Planetary Institute, Houston, TX). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

A semi-empirical model described previously satisfactorily reproduced a number of shielding-dependent variations in the relative production rates of spallogenic He and Ne in chondrites. However, data for cores of the Keyes and St. Severin meteorites showed a subsurface build-up in He-3 which was not predicted with the original model parameters and the model was not pursued. Renewed interest in the preatmospheric size of meteorites, spurred in part by the desirability of understanding the exposure history of the SNC meteorites, justifies redetermination of model parameters.

14550 (N—86-32348, pp vp) **10Be contents of SNC meteorites.** Pal, D.K.; Tuniz, C.; Moniot, R.K.; Savin, W.; Vajda, S.; Kruse, T.; Herzog, G.F. (Istituto Nazionale di Fisica Nucleare, Trieste, Italy; Fordham Univ., New York, NY; New Jersey Institute of Technology, Newark). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Several authors have explored the possibility that the Shergottites, Nakhlites, and Chassigny (SNC) came from Mars. The spallogenic gas contents of the SNC meteorites have been used to: constrain the sizes of the SNC's during the last few million years; to establish groupings independent of the geochemical ones; and to estimate the likelihood of certain entries in the catalog of all conceivable passages from Mars to Earth. The particular shielding dependence of Be-10 makes the isotope a good probe of the irradiation conditions experienced by the SNC meteorites. The Be-10 contents of nine members of the group were measured using the technique of accelerator mass spectrometry. The Be-10 contents of Nakhla, Governador Valadares, Chassigny, and probably Lafayette, about 20 dpm/kg, exceed the values expected from irradiation of the surface of a large body. The Be-10 data therfore do not support scenario III of Bogard et al., one in which most of the Be-10 in the SNC meteorites would have formed on the Martian surface; they resemble rather the Be-10 contents found in many ordinary chondrites subjected to 4 Pi exposures. The uncertainties of the Be-10 contents lead to appreciable errors in the Be-10 ages, t(1) = -1/lambda ln(1 Be-10/Be-10). Nonetheless, the Be-10 ages are consistent with the Ne-21 ages calculated assuming conventional, small-body production rates and short terrestrial ages for the finds. It is believed that this concordance strengthens the case for at least 3 different irradiation ages for the SNC meteorites. Given the similar half-thicknesses of the Be-10 and Ne-21 production rates, the ratios of the Be-10 and Ne-21 contents do not appear consistent with common ages for any of the groups. In view of the general agreement between the Be-10 and Ne-21 ages it does not seem useful at this time to construct multiple-stage irradiation histories for the SNC meteorites.

14551 (N—86-32348, pp vp) **Studies on cosmogenic nuclides in meteorites with regard to an application as potential depth indicators.** Sarafin, R.; Herpers, U.; Englert, P.; Wieler, R.; Signer, P.; Bonani, G.; Hofmann, H.J.; Morenzoni, E.; Nessi, M.; Suter, M. (Eidgenoessische Technische Hochschule, Zurich, Switzerland). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Measurements of stable and radioactive spallation products in meteorites allow to investigate their histories, especially with respect to the exposure to galactic cosmic ray particles and the preatmospheric size of the object. While the concentrations of spallation products lead to the determination of exposure and terrestrial ages, production rate ratios are characteristic for the location of the sample in the meteorite. So, one of the aims of this investigation on meteorites is to obtain depth indicators from suitable pairs of cosmogenic nuclides. Because of the different depth profiles for nuclide productions it is necessary to determine the concentrations of a larger number of spallation products in aliquots of a single small sample. Such same sample measurements of Be-10 and light noble gases were performed on 15 ordinary chondrites (7 H- and 8 L-chondrites. Be-10 was determined by accelerator mass spectrometry and the noble gases were measured by static mass spectrometry. The results are summarized and discussed.

14552 (N—86-32348, pp vp) **Production rate of cosmogenic 21-Ne in chondrites deduced from 81-Kr measurements.** Schultz, L.; Freundel, M. 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Cosmogenic Ne-21 is used widely to calculate exposure ages of stone meteorites. In order to do so, the production rate P(21) must be known. This rate, however, is dependent on the chemical composition of the meteorite as well as the mass of, and position within, the meteoroid during its exposure to the cosmic radiation. Even for a mean shielding the production rates determined from measurments of different radionuclides vary by a factor of two. A method that can be used to determine exposure ages of meteorites that avoids shielding and chemical composition corrections is the -81-Kr-Kr-method. However, for chondrites, in many cases, the direct determination of production rates for the Kr isotopes is pre-

vented by the trapped gases and the neutron effects on bromine. Therefore, this method was applied to four eucrite falls and then their 81-Kr-83-Kr-ages were compared to their cosmogenic Ne-21 and Ar-38 concentrations. The eucrites Bouvante-le-Haut, Juvinas, Sioux County, and Stannern were chosen for these measurements because of their similar chemical composition regarding the major elements.

14553 (N—86-32348, pp vp) **Neutron capture production rates of cosmogenic ^{60}Co, ^{59}Ni and ^{36}Cl in stony meteorites.** Spergel, M.S.; Reedy, R.C.; Lazareth, O.W.; Levy, P.W. (Los Alamos National Lab., NM; Brookhaven National Lab., Upton, NY). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

Results for neutron flux calculations in stony meteoroids (of various radii and compositions) and production rates for Cl-36, Ni-59, and Co-60 are reported. The Ni-59/Co-60 ratio is nearly constant with depth in most meteorites: this effect is consistent with the neutron flux and capture cross section properties. The shape of the neutron flux energy spectrum, varies little with depth in a meteorite. The size of the parent meteorite can be determined from one of its fragments, using the Ni-59/Co-60 ratios, if the parent meteorite was less than 75 g/cm(2) in radius. If the parent meteorite was larger, a lower limit on the size of the parent meteorite can be determined from a fragment. In C3 chondrites this is not possible. In stony meteorites with R less than 50 g/cm(2) the calculated Co-60 production rates (mass less than 4 kg), are below 1 atom/min g-Co. The highest Co-60 production rates occur in stony meteorites with radius about 250 g/cm(2) (1.4 m across). In meteorites with radii greater than 400 g/cm(2), the maximum Co-60 production rate occurs at a depth of about 175 g/cm(2) in L-chondrite, 125 g/cm(2) in C3 chrondrite, and 190 g/cm(2) in aubrites.

14554 (N—86-32348, pp vp) **Simulation of cosmic irradiation conditions in thick target arrangements.** Theis, S.; Englert, P.; Reedy, R.C.; Arnold, J.R. (Los Alamos National Lab., NM; California Univ., San Diego). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

One approach to simulate 2-pi irradiation conditions of planetary surfaces which has been widely applied in the past are bombardments of so called thick targets. A very large thick target was exposed recently to 2.1 GeV protons at the Bevatron-Bevalac in Berkeley. In a 100x100x180 cm steel-surrounded granodiorite target radioactive medium and high energy spallation products of the incident primary and of secondary particles were analyzed along the beam axis down to depths of 140 g/cm(2) in targets such as Cu, Ni, Co, Fe, T, Si, SiO_2 and Al. Activities of these nuclides were exclusively determined via instrumental gamma-ray spectroscopy. Relative yields of neutron capture and spallation products induced in Co and Cu targets during the thick target bombardment are shown as a function of depth. The majority of the medium energy products such as Co-58 from Co targets exhibit a maximum at shallow depths of 40-60 g/cm(2) and then decrease exponentially. In a comparable 600 MeV proton bombarded thick target such a slight maximum for medium energy products was not observed. Rather, Co-58 activities in Co decreased steadily with the highest activity at the surface. The activities of the n-capture product Co-60 increase steadily starting at the surface. This indicates the rapidly growing flux of low energy neutrons within the target.

14555 (N—86-32348, pp vp) **Cosmogenic rare gases and 10-Be in a cross section of Knyahinya.** Wieler, R.; Signer, P.; Herpers, U.; Sarafin, R.; Bonani, G.; Hofmann, H.J.; Morenzoni, E.; Nessi, M.; Suter, M.; Woelfli, W. (Cologne Univ., West Germany). 1986. NTIS, PC A05/MF A01. (NASA-CR—176886; NAS—1.26:176886; LPI-TR—86-06; CONF-8407190—Absts.).

From Workshop on cosmogenic nuclides; Los Alamos, NM, USA (26 Jul 1984).

The concentrations of cosmogenic nuclides were studied as a function of shielding on samples from a cross section of the 293 kg main fragment of the L5 chondrite Knyahinya. The stone broke into two nearly symmetrical parts upon its fall in 1866. The planar cross section has diameters between 40 and 55 cm. He, Ne, and Ar were measured on about 20 samples by mass spectrometry and the 10-Be activities on aliquots of 10 selected samples were determined by AMS. The 10-Be data are presented and the abundances of spallogenic nuclides are compared with the model calculations reported by Reedy for spherical L chondrites. The 10-Be production rates in Knyahinya are shown versus the shielding parameter 22-Ne/21-Ne.

14556 (N—87-10419, pp vp) **Analysis of mesospheric coherent-scatter power enhancements during solar flare events.** Parker, J.; Bowhill, S.A. Jun 1986. NTIS, PC A22/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801. (NASA-CR—176882; NAS—1.26:176882; MAP-HANDBK—20; CONF-8510389—1).

From URSI/SCOSTEP workshop on technical and scientific aspects of MST radar; Aguadilla, Puerto Rico (21 Oct 1985).

Solar flares produce increases in coherent-scatter power from the mesosphere due to the increase in free electrons produced by x-ray photoionization. Thirteen such power enhancements were observed at Urbana. When such an enhancement occurs at an altitude containing a turbulence layer with constant strength, the relative enhancement of electon density is estimated from the enhancement in power. Such estimates of enchanced electron density are compared with estimates of the x-ray photoionization at that altitude, deduced from geostationary satellite measurements. It is found that possible types of ion-chemical reaction schemes may be distinguished, and the nonflare ion-pair production function may be estimated. The type of ion-chemical scheme and the nonflare ion-production function are shown to depend on the solar zenith angle.

14557 (N—87-10786) **Molecular clouds in the Carina arm.** Grabelsky, D.A. (National Aeronautics and Space Administration, New York (USA). Goddard Inst. for Space Studies). Sep 1986. 358p. (NASA-TM—87798; NAS—1.15:87798). NTIS, PC A16/MF A01.

Results from the first large-scale survey in the CO(J = 1 to 0) line of the Vela-Carina-Centaurus region of the Southern Milky Way are reported. The observations, made with the Columbia University 1.2 m millimeter-wave telescope at Cerro Tololo, were spaced every beamwidth (0.125 deg) in the range 270 deg is less than or = l is less than or = 300 deg and -1 deg less than or = b less then or = 1 deg, with latitude extensions to cover all Carina arm emission beyond absolute b = 1 deg. In a concurrent survey made with the same telescope, every half-degree in latitude and longitude was sampled. Both surveys had a spectral coverage of 330 km/s with a resolution of 1.3 km/s. The Carina arm is the dominant feature in the data. Its abrupt tangent at l is approx. = 280 deg and characteristic loop in the l,v diagram are unmistakable evidence for CO spiral structure. When the emission is integrated over velocity and latitude, the height of the step seen in the tangent direction suggests that the arm-interarm contrast is at least 13:1. Comparison of the CO and H I data shows close agreement between these two species in a segment of the arm lying outside the solar circle. The distribution of the molecular layer about the galactic plane in the outer Galaxy is determined. Between R = 10.5 and 12.5 kpc, the average CO midplane dips from z = -48 to -167 pc below the b = 0 deg plane, following a similar well-known warping of the H I layer. In the same range of radii the half-thickness of the CO layer increases from 112 to 182 pc. Between l = 270 deg and 300 deg, 27 molecular clouds are identified and cataloged along with heliocentric distances and masses. An additional 16 clouds beyond 300 deg are cataloged from an adjoining CO survey made with the same telescope. The average mass for the Carina arm clouds is 1.4x 10(6)M (solar), and the average intercloud spacing along the arm is 700 pc.

14558 (N—87-10789) **High resolution CCD spectra of stars in globular clusters. Part 2: metals and CNO in M71.** Leep, E.M.; Oke, J.B.; Wallerstein, G. (Washington Univ., Seattle (USA)). 1986. 24p. (NASA-CR—179853; NAS—1.26:179853). NTIS, PC A02/MF A01.

Palomar coude CCD spectra of resolution 0.3 and 0.6 has been used to redetermine abundances in five stars of the relatively

metal rich globular cluster M71. The (Fe/H) value is restricted to the limits of -0.6 to -1.0. The largest source of uncertainty is a systematic difference in f-values between those derived via the Holweger-Muller (1974) solar model and the Bell, et al., (1976) solar model. If we use absolute f-values measured by the Oxford group (Blackwell, et al., 1982) we find Fe/H to lie in the range of -0.6 to -0.75, i.e., as given by using the Bell, et al., solar model. The relative abundances of the light elements, i.e., Na through Ca and probably including Ti show an average excess relative to iron of 0.4 dex. The effect of this difference on metal indices derived from broad- and narrow- band photometry is discussed. For three stars we find O/H = -0.6 using absolute f-values. For CN an analysis of individual rotational lines of the 2-0 band of the red system yields lines in the (C/H,N/H) plane that are consistent with either an original C/Fe = N/Fe = 0 or a modest increase in N relative to C due to CN burning and mixing. A search for C-13N was not successful and an uncertain lower limit of C-12/C-13 near 10 was obtained.

14559 **(N—87-10790) Spectroscopy of the globular clusters in M87.** Mould, J.R.; Oke, J.B.; Nemec, J.M. (California Inst. of Tech., Pasadena (USA)). Jul 1986. 26p. (NASA-CR—179854; NAS—1.26:179854). NTIS, PC A03/MF A01.

With a velocity dispersion of 370 + or - 50 km/sec the globular cluster system of M87 is kinematically hotter than the stars in the giant elliptical itself. This is consistent with the clusters' shallower density distribution for isotropic orbits. The mean metallicity of the 27 clusters in the sample analyzed here is no more than a factor of 2 more metal rich than the cluster system of the Milky Way, but considerably more metal poor than the integrated starlight in the field at a radius of 1' from the center of M87. There is no evidence for the existence of young clusters in the system. The mass-radius relation between 1' and 5' required to contain the globular clusters joins on to that required to contain the hot gas around M87.

14560 **(N—87-11651) Combined ultraviolet studies of astronomical sources. Semiannual Progress report, 1 February-31 July 1986.** Baliunas, S.L.; Dupree, A.K.; Elvis, M.; Huchra, J.P.; Kenyon, S.; Raymond, J.C. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). Oct 1986. 11p. (NASA-CR—179784; NAS—1.26:179784; SAPR—12). NTIS, PC A02/MF A01.

Topics addressed include: Cygnus Loop; P Cygni profiles in dwarf novae; YY Gem; nova shells; HZ Herculis; activity cycles in cluster giants; Alpha Ori; metal deficient giant stars; ultraviolet spectra of symbiotic stars detected by the Very Large Array; time variability in symbiotic stars; blue galaxies; and quasistellar objects with x-ray spectra.

14561 **(N—87-11652) Far-infrared spectral studies from the G. P. Kuiper Airborne Observatory. Final Technical report, 1 October 1978-31 October 1986.** Harwit, M. (Cornell Univ., Ithaca, NY (USA)). Oct 1986. 8p. (NASA-CR—179879; NAS—1.26:179879). NTIS, PC A02/MF A01.

The grant to carry out far-infrared spectral studies of astronomical sources from the G. P. Kuiper Airborne Observatory was first funded in October 1978 and officially ended on October 31, 1986. During these eight years, a variety of previously undetected spectral lines was discovered, and these were used to determine the physical and chemical conditions prevailing in regions of active star formation. They served to clarify the nature of the ionized hydrogen regions often adjacent to star-forming clouds, the characteristics of shocks which may signify the onset of star formation, and the nature of coolants that channel away energy thus enabling a cloud to collapse to form new stars.

14562 **(N—87-11653) UV observations of blue stragglers and population 2 K dwarfs. Final Technical report, 1 July 1984-30 June 1986.** Carney, B.W.; Bond, H.E. (North Carolina Univ., Chapel Hill (USA)). 1986. 4p. (NASA-CR—179865; NAS—1.26:179865). NTIS, PC A02/MF A01.

Blue stragglers are stars, found usually in either open or globular clusters, that appear to lie on the main sequence, but are brighter and bluer than the cluster turn-off. Currently, two rival models are invoked to explain this apparently pathological behavior: internal mixing (so that fresh fuel is brought into the stellar core); and mass transfer (by which a normal main sequence star acquires mass from an evolving nearby companion and so moves up the main sequence). The latter model predicts that in the absence of complete mass transfer (i.e., coalescence), blue stragglers should be binary systems with the fainter star in a post-main sequence evolutionary state. It is important to ascertain the cause of this phenomenon since stellar evolution models of main sequence stars play such a vital role in astronomy. If mass transfer is involved, one may easily exclude binaries from age determinations of clusters, but if mixing is the cause, our age determinations will be much less accurate unless we can determine whether all stars or only some mix, and what causes the mixing to occur at all.

14563 **(N—87-11672) Studies of the composition of solar particles and of energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere. Final report, 15 May 1981-15 May 1984.** Stone, E.C. (California Inst. of Tech., Pasadena (USA)). Nov 1986. 17p. (NASA-CR—179863; NAS—1.26:179863). NTIS, PC A02/MF A01.

The Cosmic Ray System (CRS) experiment on board each of the Voyager 1 and 2 spacecraft consists of four Low Energy Telescopes (LETs), two High Energy Telescopes (HETs), the Electron Telescope (TET), and associated electronics. With these instruments it is possible to measure the energy spectrum of electrons over the 3-110MeV energy range and the energy spectra and nuclear charge of atomic nuclei from hydrogen through zinc over the 3-500 MeV/nuc energy range. The exclusive use of solid-state detectors in the CRS telescopes achieves the objectives of reliability over a long mission life, high resolution determinations of energy and charge, and high-count-rate capability during large solar flares and passage through the magnetospheres of the outer planets. Summarized here are some of the many accomplishments that have resulted from the CRS measurements during the period covered by this report, May 15, 1981 to May 15, 1984, including studies of the energetic oxygen and sulfur nuclei trapped in the Jovian magnetosphere.

14564 **(N—87-11676) International Solar-Terrestrial Program Data Processing Consortium. Final report.** Torbert, R.B. (Alabama Univ., Huntsville (USA)). Sep 1986. 11p. (NASA-CR—178919; NAS—1.26:178919; UAH—530). NTIS, PC A02/MF A01.

The present conception of the data processing scheme is described including the Main Processing Units (MPU) and Satellite Processing Units (SPU) which will acquire the data for the instruments presently planned in the International Solar Terrestrial Physics (ISTP) Project.

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REFER ALSO TO CITATION(S) 14503, 14504

14565 **(AD-A—173132/2/XAB) Theory of vhf (very high frequency) scattering by field-aligned irregularities in the ionosphere. Interim report, June 1984-August 1985.** Malaga. (Signatron, Inc., Lexington, MA (USA)). Sep 1986. 70p. (A—447-12). NTIS, PC A04/MF A01.

The theory describing the scattering of vhf radiowaves by anisotropic irregularities aligned along the earth's magnetic field is presented and applied to treat auroral scatter. Results showing the aspect sensitivity, polarization effects, antenna bandwidth effects and frequency dependence of auroral are presented.

14566 **(AD-A—173387/2/XAB) Millstone hill observations of ionospheric convection.** Holt, J.M.; Evans, J.V.; Oliver, W.L.; Wand, R.H. (Haystack Observatory, Westford, MA (USA)). 1984. 20p. NTIS, PC A02/MF A01.

Incoherent-scatter measurements of convection electric fields were carried out at Millstone Hill (latitude = 56°) since 1978. These measurements permitted the convection pattern on individual days to be determined over the invariant latitude range $60^{\circ} < \text{or} = \text{Lambda} < \text{or} = 75^{\circ}$ with a time resolution as short as 11 minutes. By assuming that the pattern may be derived from an electrostatic potential, snapshots of the potential within the field of view of the

radar also have been obtained. Finally average patterns, based on many days of measurements, are discussed.

14567 **(AD-A—173658/6/XAB) Daily magnetograms for 1979 from the AFGL (Air Force Geophysics Laboratory) network. Technical report.** Knecht, D.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 22 Feb 1985. 417p. (AFGL-TR—85-0028). NTIS, PC A18/MF A01.

A stacked plot of 24-hour magnetograms from the AFGL Magnetometer Network is presented for each UT day of the year 1979. Each plot, on a single page, contains all 21 traces from the fluxgate magnetometers of the network (three components at seven stations). The data plotted are 2-min averages of the 1-min edited data set provided to the World Data Center. To aid in comparisons between days, the magnetograms are plotted with a fixed-amplitude scale that preserves a resolution of one or two nanoteslas. For the 10% of all days that are more active, the plots were repeated at a reduced amplitude. These magnetograms serve to assess the general character of magnetic activity, identify events for scientific study, and indicate the coverage and quality of the data available from the World Data Center.

14568 **(AD-A—173742/8/XAB) Daily magnetograms for 1982 from the AFGL (Air Force Geophysics Laboratory) network. Special report.** Knecht, D.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 Mar 1985. 430p. (AFGL-TR—85-0031). NTIS, PC A19/MF A01.

A stacked plot of 24-hour magnetograms from th AFGL Magnetometer Network is presented for each UT day of the year 1982. Each plot, on a single page, contains all 21 traces from the fluxgate magnetometers of the network (three components at seven stations). The data plotted are 2-min averages of the 1-min edited data set provided to the World Data Center. To aid in comparisons between days, the magnetograms are plotted with a fixed-amplitude scale that preserves a resolution of one or two nanoteslas. For the 10% of all days that are more active, the plots were repeated at a reduced amplitude. These magnetograms serve to assess the general character of magnetic activity, identify events for scientific study, and indicate the coverage and quality of the data available from the World Data Center.

14569 **(AD-A—173758/4/XAB) POLAR user's manual. Final report, May 1982-September 1985.** Lilley, J.R.; Cooke, D.L.; Jongeward, G.A.; Katz. (S-Cubed, San Diego, CA (USA)). Oct 1985. 271p. (SSS-R—86-7563). NTIS, PC A12/MF A01.

This report documents the physical principles and computational algorithms of the POLAR Code. POLAR models in three dimensions the interactions of large spacecraft with the plasma environment in low polar orbit. It includes models of space-charge-limited particle collection, satellite wakes, the polar auroral environment, magnetic-field effects, spacecraft surface charging, particle-beam effects, and sheath ionization.

14570 **(AD-A—173765/9/XAB) Daily magnetograms for 1983 from the AFGL (Air Force Geophysics Laboratory) network. Special report.** Knecht, D.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 21 Mar 1985. 421p. (AFGL-TR—85-0032). NTIS, PC A18/MF A01.

A stacked plot of 24-hour magnetograms from the AFGL Magnetometer Network is presented for each UT day of the year 1983. Each plot, on a single page, contains all 21 traces from the fluxgate magnetometers of the network(three components at seven stations). The data plotted are 2-min averages of the 1-min edited data set provided to the World Data Center. To aid in comparisons between days, the magnetograms are plotted with a fixed-amplitude scale that preserves a resolution of one or two nanoteslas. For the 10% of all days that are more active, the plots were repeated at a reduced amplitude. These magnetograms serve to assess the general character of magnetic activity, identify events for scientific study, and indicate the coverage and quality of the data available from the World Data Center.

14571 **(AD-A—173822/8/XAB) MHD simulation of the interplanetary environment in the ecliptic plane during the 3-9 February 1986 solar and geomagnetic activity. Report for November 1985-September 1986.** Dryer, M.; Smith, Z.K.; Detman, T.R.; Yeh, T. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Sep 1986. 75p. (AFGL-TR—86-0189). NTIS, PC A04/MF A01.

A numerical simulation is performed for the interplanetary medium's response to 6 solar flares that were observed, sequentially, in real time by NOAA and AWS instruments 3-7 Feb 1986. This is of great practical interest because of the extensive geomagnetic disturbances and associated near-Earth activity that followed these flares on 6-9 Feb. The magnetodhydrodynamic simulation is carried out with the Space Environment Laboratory's 2-1/2D Interplanetary Global Model code. It demonstrates the multiple, compound interactions of the interplanetary disturbances produced by these flares by using input perturbations based upon real-time optical, radio, and satellite observations. The optical (H-alpha) and radio (microwave to metric wavelength) data were obtained from the SOON/RSTN sites, and full-disk-integrated x-ray measurments were obtained from the NOAA/GOES-5 and -6 satellites. Examination of the simulated solar-wind output (such as momentum flux, and cross-magnetospheric tail electric field) at Earth's position indicates that the major geomagnetic activity was probably due primarily to the second and fifth solar flares in the sixfold sequence. Predicated geomagnetic-storm sudden commencement times were early by only about 4% (3-4 hours) for the pulses suggested by the consequences of the 2d and 6th flares. The 180-hour simulation, which required only 100 seconds (CPU time) on the NOAA/NBS CYBER 855/205, required 8 hours clock time on the SEL's APOLLO workstation.

14572 **(AD-A—173923/4/XAB) Electric fields in earth orbital space. Annual report, September 1985-October 1986.** Olson, W.P.; Pfitzer, K.A. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). 30 Oct 1986. 67p. NTIS, PC A04/MF A01.

A model of the ground-state magnetosphere was developed that suggested that the basic magnetosphere is formed and maintained simply by the interaction of the solar wind with the geomagnetic field. It is known, however, that the magnetosphere responds dynamically to changes in the interplanetary magnetic field (IMF). Instead of the qualitative reconnection theory, this response is examined in terms of electromagnetic wave propagation in the interplanetary region. The interplanetary plasma (solar wind) is magnetized there by the solar magnetic sector structure. Electromagnetic waves of higher frequency can propagate through the solar wind without appreciable attenuation. It is the interaction of these disturbance waves with the magnetosphere that causes the observed magnetospheric response to the IMF. The propagation of electromagnetic disturbances in the interplantary region and their interaction with the magnetosphere is examined quantitatively. Only certain modes propagate and there are further restrictions on the waves at the waves at the magnetopause. A southward IMF produces the most dramatic magnetospheric response in the tail region and a northward IMF in the polar cusp region.

14573 **(AD-A—173958/0/XAB) Daily magnetograms for 1981 from the AFGL (Air Force Geophysics Laboratory) network. Special report.** Knecht, D.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 28 Feb 1985. 429p. (AFGL-TR—85-0030). NTIS, PC A19/MF A01.

A stacked plot of 24-hour magnetograms from the AFGL Magnetometer Network is presented for each UT day of the year 1981. Each plot, on a single page, contains all 21 traces from the fluxgate magnetometers of the network (three components at seven stations). The data plotted are 2-min averages of the 1-min edited data set provided to the World Data Center. To aid in comparisons between days, the magnetograms are plotted with a fixed amplitude scale that preserves a resolution of one or two nanoteslas. For the days that are more active, the plots have been repeated at a reduced amplitude. These magnetograms serve to assess the general character of magnetic activity, identify events for scientific study, and indicate the coverage and quality of the data available from the World Data Center.

14574 **(AD-A—174036/4/XAB) Spatial variability of total electron content in the eastern Mediterranean region.** Soicher; Klobuchar, J.A.; Doherty, P.H. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Jun 1984. 9p. (AFGL-TR—86-0230). NTIS, PC A02/MF A01.

Faraday-rotation observations were conducted at Haifa, Israel (32.87N, 35.09E), and Athens, Greece (37.97N, 23.72E), during the maximum phase of the current solar cycle using the VHF beacon of the SIRIO satellite. The subionospheric points (at 420km) are (29.9N, 27.9E) and (34.5N, 18.4E), and the subionospheric L-shell values are 1.24 and 1.37, respectively. Expected latitudinal and local time differences in total electron content (TEC) for the two locales are observed. However, the Haifa data are characterized by generally occurring, seasonally independent, large postsunset electron content maxima which are absent for the Athens data. Furthermore, the postsunset increases would appear to be a solar-maximum phenomenon, as they are not observed during the minimum phase of the solar cycle. The postsunset increases are attributed to electron fluxes arriving from the equatorial regions along the magnetic lines of force. The correlation coefficients of hourly TEC at the Haifa/Athens locales exhibit a seasonally independent diurnal variation with minimum values at night and maximum values generally at the end of the buildup phase of TEC variation. The daytime ratios of the standard deviation of TEC to the average TEC are generally seasonally independent and behave quite similarly at the two locals, with daytime values below about 25%.

14575 **(AD-A—174047/1/XAB) Conductance of auroral magnetic field lines.** Weimer, D.R.; Gurnett, D.A.; Goertz, C.K. (Regis Coll., Weston, MA (USA). Research Center). 1986. 7p. NTIS, PC A02/MF A01.

Recent results from the Dynamics Explorer satellites have indicated that in the auroral zone a linear relationship exists between the field-aligned current density and the potential drop parallel to the magnetic field lines. Evidence for this Ohm's law relationship was found in the mapping of perpendicular electric fields and field-aligned currents between high and low altitudes. The mapping depends on the perpendicular wavelength of the electric-field variations. A scale length in the mapping formula is determined by the ratio of the parallel field line conductance and the ionospheric Pedersen conductance. The wavelength and the conductivity ratio also control the relationship between the perpendicular electric and magnetic fields at high altitudes. The short-wavelength limit in the ionospheric conductivity is no longer important in the relationship between the north-south electric field and the east west magnetic field at high altitudes (i.e., above the parallel potential drop). At the short wavelength limit, the relationship takes on a simple form: the integral of the perpendicular electric field results in a potential profile which, according to the linear theory, is proportional to the current density. Assuming that the currents are in the form of infinite sheets orientated east-west, the second integral of the electric field is proportional to the magnetic field.

14576 **(AD-A—174216/2/XAB) Condor equatorial Spread F campaign. Overview and results of the large-scale measurements.** Kelley, M.C.; LaBelle, J.; Kudeki, E.; Fejer, B.G.; Basu, S. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 May 1986. 19p. (AFGL-TR—86-0229). NTIS, PC A02/MF A01.

During the Condor campaign a number of instruments were set up in Peru to support the rocket experiments. This overview paper summarizes the main results on the macroscopic developments of spread F as evidenced by data from backscatter radars, from scintillation observations, and from digital ionosonde measurements. In this regard, at least two factors other than the classical gravitational Rayleigh-Taylor plasma instability process must operate to yield the longest scales horizontal organization of spread F structures. The horizontal scale typical of plume separation distances can be explained by invoking the effect of a shear in the plasma flow, although detailed comparison with theory seems to require shear frequencies a bit higher than observations indicate. On the other hand, the largest-scale organization or modulation of the scattering layer cannot be explained by the shear theory and must be due to local time variations in the ionospheric drift or to gravity wave induced vertical motions. Using simultaneous rocket and radar data, it is hypothesized that rapid overhead height variations in the scattering region over Jicamarca are primarily spatial structures advecting overhead. The detailed rocket-radar comparison verified several other earlier results and speculations, particularly those made in the PLUMEX experiments.

14577 **(AD-A—174272/5/XAB) Simple model of auroral electrodynamics compared with HILAT measurements.** Doyle, M.A.; Burke, W.J.; Hardy, D.A.; Bythrow, P.F.; Rich, F.J. (Regis Coll., Weston, MA (USA). Research Center). 1 Jun 1986. 9p. NTIS, PC A02/MF A01.

Simultaoneous measurements of cold plasma-drift velocities, magnetic field pertubations, and precipitating-electron fluxes with instrumentation on board the HILAT satellite provide an opportunity to correlate Birkeland current densities, electric fields, and ionospheric conductivities in the region of an auroral form. Typical plasma parameters such as ion density, temperature, and composition and electron density and temperature are also available. On July 17, 1983, the satellite crossed the northern auroral zone in the early morning, magnetic local time sector. As the satellite crossed a bright auroral form, recorded by the auroral imager-mapper, the particle spectrometer detected a 2-orders-of-magnitude increase in the flux of $>$ 10-keV electrons. The precipitating electrons of this event produced a double inverted-V structure embedded in the large-scale, region 2 field-aligned current sheet. This papers presents calculation of the component of the electric field along the satellite trajectory and perpendicular to the auroral form, given the Birkeland current feeding the auroral form and conductivities derived from particle-preciptiation data. Emphasis is placed on accurately representing the Birkeland current density in the region of the bright auroral form. In general, large-scale features are well represented by the calculations. Although small-scale features are not well tracked, calculations of the auroral zone potential drop and the height-integrated Joule heating varied by less than 2% from measured values. During this particular pass, the ionospheric Joule heating exceeded the particle energy deposition along the satellite trajectory by a factor of 2.6.

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REFER ALSO TO CITATION(S) 13790, 14172, 14842, 14864, 14928, 14932, 15000, 15047, 15119, 15127

14578 **(AD-A—173899/6/XAB) Theoretical studies relating to the interaction of radiation with matter: atomic-collision processes occurring in the presence of radiation fields. Annual report No. 9, 1 August 1985-31 July 1986.** Berman, P.R. (New York Univ., NY (USA). Dept. of Physics). 1 Oct 1986. 14p. NTIS, PC A02/MF A01.

Work is reported in areas of: (1) Creation of Electronic-State Coherences via Laser Assisted Collisions; (2) Collision Effects in Four-Wave Mixing and Pump-Probe Spectroscopy; (3) Modified Optical Bloch Equations in Solids; (4) Transient Spectra in Atom-Field Interactions; (5) Collision Kernels and Transport Coefficients; (6) Collisions in Strong cw and Transient Laser Fields; (7) Quantum vs Classical Description of Laser Fields; (8) Intense Optical Noise Sources; and (9) Laser-Assisted Collisions.

14579 **(BNL—39001) Determination of neutral beam direction from radiation emitted by photodetached H^-.** Hershcovitch, A. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 10p. (CONF-8610115—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004174.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

Non-destructive diagnostic techniques to determine beam direction of 200 MeV H^0 atoms are analyzed. These methods are based on excited hydrogen atoms in n=2 and n=3 levels due to photodetachment of H^- ions. With some development of hot cathodes, an e-beam driven ArF laser can produce $H^*(2s)$ atoms for laser resonance fluorescence by photoneutralizing H^- ions in a quantity comparable to that of a gas cell. Observation of fluorescence from spontaneous decay of $H^*(2p)$ or induced decay of

H*(2s) can be readily used to indicated beam orientation with a 40 μrad accuracy. Measurements of minute Doppler shifts of this Lyman Alpha radiation by a spectrograph could in principle resolve beam direction to within 2.8 μrad. For schemes requiring n=3 hydrogen atoms, a Xe laser can produce H*(3s) or H*(3p) atoms in quantities larger than previously published. 11 refs., 3 figs.

14580 **(CONF-861114—36) Surgery of fast, highly charged ions studied by zero-degree Auger spectroscopy.** Stolterfoht, N.; Miller, P.D.; Krause, H.F.; Yamazaki, Y.; Swenson, J.K.; Bruch, R.; Dittner, P.F.; Pepmiller, P.L.; Datz, S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003655.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

Zero-degree Auger spectra were measured in collisions of oxygen and carbon on He with incident charge states of q = 2 to 5 and for energies from 5 to 30 MeV. Since the light target particle He acts selectively on the projectile ion, we refer to the present method as ion surgery. Apart from the one-electron processes single excitation and single loss, two-electron processes such as transfer excitation and transfer loss are studied. 17 refs., 4 figs., 1 tab.

14581 **(DOE/ER/13262—3) X-ray emission in heavy ion collisions: A progress report for the period July 1, 1984 to January 1, 1987.** Watson, R.L. (Texas A and M Univ., College Station (USA). Cyclotron Inst.). Jan 1987. Contract FG05-84ER13262. 82p. NTIS, PC A05/MF A01. File Number DE87005300.

The focus of this research program has been on the investigation of ionization, excitation and electron transfer in fast heavy ion collisions by means of moderately high resolution measurements of the photon radiation emitted during and after the collision process. The wavelength region of interest in these studies extends from the EUV up to x-rays in the keV range. The major objectives of this work were (1) to characterize mechanisms for populating states in highly stripped ions; (2) to identify chemical and environmental (i.e. electron density) influences on transition energies, widths and intensities, and to examine the alignment of few-electron states produced in projectile-foil and projectile-gas interactions. A brief summary of the most noteworthy accomplishments of this program is given. 50 refs., 19 figs., 10 tabs.

14582 **(DOE/ER/13332—2) Spectroscopic studies of hydrogen atom and molecule collisions: Performance report.** Kielkopf, J. (Louisville Univ., KY (USA). Dept. of Physics). 29 Aug 1986. Contract FG05-85ER13332. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004411.

This research is concerned with spectroscopic measurements of collisions in atomic and molecular hydrogen in order to clarify the basic physical processes that take place during radiative collisions and to provide experimental values for systems where the theoretical analysis is tractable. To this end, we proposed to measure from the cores to the far wings the profiles of the spectral lines of atomic hydrogen broadened by molecular hydrogen and noble gases, and to study energy transfer in the atom and molecule.

14583 **(INIS-mf—9834) Atomic excitations in heavy ion collisions with nuclear contact.** (Frankfurt Univ. (Germany, F.R.)). 5 Jul 1984. 310p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE87780057.

The dynamical semiclassical theory of atomic excitations, especially of positron creation, in heavy ion scattering is presented and extended to collisions with nuclear contact. The characteristic dependence of inner shell vacancy formation on nuclear reaction times as well as the emergence of interference patterns in the energy spectra of emitted delta-electrons and positrons in delayed collisions is discussed in terms of a simplified, schematic model for the nuclear reaction dynamics. In addition, the spontaneous decay mechanism in giant nuclear systems with Z > or approx. 173 leads, for sufficiently long reaction times, to a characteristic line in the positron spectra at the position of the Issigma-resonance. The position and width of the positron line is calculated in dependence on the nuclear configuration taking into account the influence of the electron-electron interaction. Furthermore, a quantum mechanical extension of our semiclassical treatment of the atomic scattering process and its effect on atomic positron spectra are discussed. In addition, the influence of E0-transitions in the giant nuclear system on positron emission is treated qualitatively in a semiclassical approximation, indicating that nuclear collective modes can be revealed by the measurement of Stokes and anti-Stokes lines in the positron spectra.

14584 (INIS-SU—392, pp 241) **Energies of the KLM Auger transitions of xenon.** Babenkov, M.I.; Zhdanov, V.S.; Starodub, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14585 (INIS-SU—392, pp 249) **Relative intensities of Auger KLM - transitions in the /sup 57/Co -> /sup 57/Fe decay.** Kovalik, A.; Inoyatov, A.Kh.; Novgorodov, A.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14586 (INIS-SU—392, pp 250) **Investigation of spectra of the Hg KX - and LX - quanta in the /sup 204/Tl decay.** Sergienko, V.A.; Vorontsovskij, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14587 (INIS-SU—392, pp 251) **Determination of L fluorescence yields of Pb atoms.** Vorontsovskij, A.V.; Sergienko, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14588 (INIS-SU—392, pp 268) **Nonrelativistic Hartree-Fock-Slater probabilities of the Auger KLMsub(1-3) transitions in the intermediate coupling, 18 < Z < 54.** Babenkov, M.I.; Zhdanov, V.S.; Petukhov, V.K.; Starodubov, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14589 (INIS-SU—392, pp 269) **Relativistic intensities of the Auger-transition groups ΣKMX/ΣKMM and ΣKXY/ΣKMM, in atoms with 46 < Z < 84.** Babenkov, M.I.; Zhdanov, V.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14590 (INIS-SU—392, pp 261) **Gauge-invariance relativistic calculations of atomic X radiation by the Hartree-Fock-Dirac method.** Band, I.M.; Listengarten, M.A.; Trzhaskovskaya, M.B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14591 (INIS-SU—392, pp 263) **On a role of some effects in the muonic E0-conversion.** Lavrenov, A.N.; Shulyakovskij, G.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14592 (INIS-SU—392, pp 267) **Sup(71)Ga K-Auger spectrum from the sub(32)sup(71)Ge decay.** Babenkov, M.I.; Zhdanov, V.S.; Starodubov, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14593 (INIS-SU—392, pp 229) **Calculation of the muon potential in a muonic atom for the case of nonaxially deformed nuclei.** Tesevich, B.I.; Trofimenko, E.E.; Kuzhir, P.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14594 (INIS-SU—392, pp 512) **Spectra of fast particles appearing in slow π/sup -/-meson absorption.** Ivankov, Yu.V.; Kadmenskij, S.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14595 (INIS-SU—392, pp 257) **γ quanta scattering by multicharged hydrogen - like ions.** Manakov, N.L.; Nezhipelov, A.A.; Fajnshtejn, A.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14596 (INIS-SU—392, pp 262) **Gauge-independent relativistic photoeffect in an atom of Hartree-Fock-Dirac.** Trzhaskovskaya, M.B.; Listengarten, M.A.; Band, I.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14597 (INIS-SU—392, pp 402) **Sputtering of targets in nuclear physics experiments.** Tsepelevich, S.O.; Baranov, I.A.; Obnorskij, V.V.; Aleksandrov, B.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14598 (INIS-SU—392, pp 562) **On positron and positronium atom annihilation in semiconductor anisotropic layers.** Prokop'ev, E.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14599 **(LBL—22011) Diffusion quantum Monte Carlo for molecules.** Lester, W.A. Jr. (Lawrence Berkeley Lab., CA (USA)). Jul 1986. Contract AC03-76SF00098. 8p. (CONF-8606173—2). NTIS, PC A02/MF A01. File Number DE87003543.

From 1. symposium on computational chemistry on Cray supercomputers; Minneapolis, MN, USA (11 Jun 1986).

A quantum mechanical Monte Carlo method has been used for the treatment of molecular problems. The imaginary-time Schroedinger equation written with a shift in zero energy [E/sub T/ - V(R)] can be interpreted as a generalized diffusion equation with a position-dependent rate or branching term. Since diffusion is the continuum limit of a random walk, one may simulate the Schroedinger equation with a function psi (note, not psi^2) as a density of "walks." The walks undergo an exponential birth and death as given by the rate term. 16 refs., 2 tabs.

14600 **(LBL—22419) Near threshold studies of photoelectron satellites.** Heimann, P.A. (California Univ., Berkeley (USA)). Nov 1986. Contract AC03-76SF00098. 164p. NTIS, PC A08/MF A01. File Number DE87004594.

Photoelectron spectroscopy and synchrotron radiation have been used to study correlation effects in the rare gases: He, Ne, Ar, Kr, and Xe. Two kinds of time-of-flight electron analyzers were employed to examine photoionization very close to threshold and at higher kinetic energies. Partial cross sections and angular distributions have been measured for a number of photoelectron satellites. The shake-off probability has been determined at some inner-shell resonances. 121 refs., 28 figs., 13 tabs.

14601 **(MIT-PR—28) RLE progress report.** Allen, J.; Birgeneau, R. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1986. 287p. NTIS, PC A13/MF A01.

Topics addressed include: submicron structures; kinetic phenomena in thin film electronic materials; focused ion beams; surface chemical reactions; quantum electronics; nonlinear optics; X-ray diffused scattering; semiconductor surfaces; custom integrated circuits; speech communication; communications biophysics; physiology; molecule microscopy; quantum optics; atomic resonance and scattering; plasma dynamics; digital signal processing; information processing; microwave and quantum magnetics; radio astronomy; and electromagnetic wave theory.

14602 **(UCRL—94314) Calculations of photoabsorption by atoms using a linear response method.** Doolen, G.; Liberman, D.A. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA)). 19 Jun 1986. Contract W-7405-ENG-48. 12p. (CONF-860845—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004352.

From 8. international conference on vacuum ultraviolet radiation physics; Lund, Sweden (4 Aug 1986).

We have made extensive calculations of photoabsorption by all neutral atoms from hydrogen to lawrencium for photon energies up to one kilovolt. Our method was the relativistic time-dependent local density approximation with the usual configuration average for open shells. The most important collective effects are included through an induced field. Expected features such as resonant photoemission and autoionization are seen. Examples of the calculations will be shown. The computer program used is available from the Computer Physics Communications Program Library. 11 refs., 6 figs.

14603 **Liquid-film electron stripper.** Gavin, B.F. (to Dept. of Energy, Washington, DC). US Patent 4,626,691. 2 Dec 1986. Filed date 1 Nov 1984. vp.

This patent describes an improved liquid-film electron stripper for high intensity heavy ion beams comprising: at least one rotatable disc mounted in a housing, means for rotating the disc, a liquid reservoir operatively connected to the housing, means for directing liquid from the reservoir onto the rotatable disc for forming a film of liquid as liquid is spun from the disc, the disc being configured to define a sharp edge located at one side of the periphery of the disc, and configured to include a flat, smooth radially outer section located adjacent the sharp edge, the liquid being directed onto the flat, smooth section of the disc, the means for directing liquid onto the disc including a nozzle positioned with respect to the disc so that liquid from the nozzle impinges at about a 90° angle with respect to the flat, smooth surface of the disc, and liquid film terminator means located in spaced relation to the disc and approximately perpendicular to a formed liquid film, the terminator means comprising at least one ribbon of material secured to the housing.

14604 Measured densities in UF_6 free jets. Hoisington, P.A.; Fisher, S.S. (Univ. of Virginia, Charlottesville, VA). pp 903-910 of Rarified gas dynamics - Vol. 2. Belotserkovskii, O.M.; Kogan, M.N.; Kutateladze, S.S.; Rebrov, A.K. New York, NY; Plenum Press (1985). (CONF-820742—).

From 13. international symposium on rarefied gas dynamics; Novosibirsk, USSR (5 Jul 1982).

This paper describes measurements of gas densities in UF free jets expanding from converging nozzles into a vacuum. These densities are deduced from measured intensities of laser photons Rayleigh scattered by the gas. The nozzle Reynolds number ranges from 1150 to 9200 degrees. Axial distances from the nozzle as large as 25 throat diameters are covered. Measured densities are in good agreement with those predicted on the basis of inviscid-flow method of characteristics calculations.

14605 Long-range attraction in the collisions of free-molecular and transition regime aerosol particles. Marlow, W.H. (Brookhaven National Lab., Upton, NY). pp 1205-1220 of Rarified gas dynamics - Vol. 2. Belotserkovskii, O.M.; Kogan, M.N.; Kutateladze, S.S.; Rebrov, A.K. New York, NY; Plenum Press (1985). (CONF-820742—).

From 13. international symposium on rarefied gas dynamics; Novosibirsk, USSR (5 Jul 1982).

It is shown that given any nontrivial initial or boundary conditions, an aerosol ultimately evolves to a state of lower internal energy due to collisions among the particles and their thermodynamically irreversible coagulation. Estimation of these collision rates is the question to which the subjects discussed in this paper make their contributions. In particular, a description of the realistic long-range interaction force and its effects upon the collisions between particles in all ranges of particle Knudsen number, Kn (Kn = 1/a, 1 - mean free path of sustaining gas, a - particle radius), is given.

14606 Pionic M X-rays of /sup 166,168/Er and ^{176}Hf. Tanaka, Y.; Steffen, R.M.; Shera, E.B.; Reuter, W.; Hoehn, M.V.; Zumbro, J.D. (Purdue Univ., West Lafayette, IN). *Physics Letters [Section] B;* **143B**: No. 4-6, 347-350(16 Aug 1984).

The X-ray energies and widths of the pionic 4f → 3d transitions (M X-rays) of /sup 166,168/Er and ^{176}Hf have been measured. The measured widths (Gamma(^{166}Er) = 19.7(0.9) keV, Gamma(^{168}Er) = 19.4(1.0) keV, and Gamma(^{176}Hf) = 27.8(4.3)kev] are in good agreement with theoretical calculations, and suggest that anomalous widths, if they exist, begin at or above Z = 73. 18 references, 2 figures, 1 table.

14607 Studies of surface enhanced optical effects by second-harmonic generation. Shen, Y.R. (Univ. of California, Berkeley). *Proceedings of the International Conference on Lasers;* 234-240(1984). Contract AC03-76SF00098.

Optical second-harmonic generation is used to study the macroscopic local-field contribution to the surface enhancement of optical effects on rough metal surfaces. The measured enhancement is independent of molecule-metal interaction at the surface. Experimental results are compared with theoretical predictions using a set of protruded hemispheroids on a plane to model after a rough surface. The agreement is fairly satisfactory, allowing the authors to use the model to predict the local-field contribution in surface-enhanced Raman scattering. A number of metals other than the noble metals are believed to have a surface enhancement as large as that on silver. The possibility of using surface-enhanced second-harmonic generation to probe molecular adsorption and desorption on on metal electrodes is also briefly discussed. 16 references, 6 figures.

14608 Modern Alchemy. Seaborg, G.T. (Lawrence Berkeley Lab., CA). *Science Teacher;* **50**: No. 8, 29-34(Nov 1983).

A historical overview is given for the IOS elements of the periodic table. The author also reviews predictions for the properties of superheavy elements yet to be found.

14609 Derivative coupling elements in electronically adiabatic representations and their use in scattering calculations. Garrett, B.C.; Melius, C.F.; Truhlar, D.G. (Battelle Columbus Lab., Columbus, OH). pp 375-096 of Energy storage and redistribution in molecules. Hinze, J. New York, NY; Plenum Press (1983). (CONF-8006137—).

From Workshop on molecular structure, rigidity, and energy surfaces and on energy scrambling in a molecule; Bielfeld, F.R. Germany (23 Jun 1980).

The authors examine one of the fundamental problems of obtaining accurate derivative coupling terms in adiabatic representations - the fact that the derivative coupling terms depend upon location of the origin of the electronic coordinates. A further complication is that for an arbitrary origin of the electronic coordinates the derivative coupling terms do not in general vanish at large inter-nuclear separations. Some methods for dealing with this long-range coupling are discussed here. To illustrate these considerations atom-atom collisions are examined. The particular examples chosen for the study are collisions of K 39 with protium (H 1) and with a fictitious heavy isotope of hydrogen (H 39). The derivative coupling terms are examined for these examples and scattering calculations for several different choices of electronic origin are compared.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 15183, 15254

14610 (LA—10826) RAVEN. Oliphant, T.A.; Witte, K.H. (Los Alamos National Lab., NM (USA)). Jan 1987. Contract W-7405-ENG-36. 58p. NTIS, PC A04/MF A01. File Number DE87004765.

The RAVEN code is discussed relative to its physical approximations, its mathematical algorithms, and its architecture. The purpose is to describe the physics of the code so that intelligent use can be made of the code with the additional aid of a user manual to be provided separately. 5 refs., 11 figs.

14611 (LA—10911-MS) Conservation and transport properties of turbulence with large density variations. Besnard, D.; Harlow, F.H.; Rauenzahn, R. (Los Alamos National Lab., NM (USA)). Feb 1987. 57p. NTIS, PC A04/MF A01. File Number DE87004763.

In this study, a turbulence model is developed for flows containing large density gradients but moving with small Mach number. In such cases, the turbulence initiates in regions with the steepest spatial variations in mean density. This model generalizes standard turbulence models and is comprised of transport equations for second-order correlations constructed from fluctuating components of density, velocity, and internal energy. From these, instability-driven source terms for turbulence arise naturally. We also exhibit the effect of nonhomogeneities in the flow on the level of turbulence. Many applications of this model can be envisioned, including meteorology, the study of stratified flow, and investigation of volcanic plumes formed during eruptions. 21 refs., 3 figs.

14612 (LBL—22388) Equilibrium fluid interfaces in the absence of gravity. Concus, P. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 5p. (CONF-861211—21). NTIS, PC A02/MF A01. File Number DE87003544.

From American Society of Mechanical Engineers winter meeting; Anaheim, CA, USA (7 Dec 1986).

Some striking mathematical properties of capillary surfaces under zero gravity conditions are discussed. We consider the equilibrium interface between a liquid and a gas, or between two immiscible liquids, in a cylindrical container of general cross-section.

14613 (N—86-31859) Advanced optical measuring systems for measuring the properties of fluids and structures. Decker, A.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1986. 37p. (NASA-TM—88829; E—3204; NAS—1.15:88829; CONF-8610194—1). NTIS HC A03/MF A01.

From Symposium on propulsion instrumentation; Jiangyou, China (6 Oct 1986).

Four advanced optical models are reviewed for the measurement of visualization of flow and structural properties. Double-exposure, diffuse-illumination, holographic interferometry can be used for three-dimensional flow visualization. When this method is combined with optical heterodyning, precise measurements of structural displacements or fluid density are possible. Time-average holography is well known as a method for displaying vibrational mode shapes, but it also can be used for flow visualization and flow measurements. Deflectometry is used to measure or visualize the deflection of light rays from collimation. Said deflection occurs because of refraction in a fluid or because of reflection from a tilted surface. The moire technique for deflectometry, when combined with optical heterodyning, permits very precise measurements of these quantities. The rainbow schlieren method of deflectometry allows varying deflection angles to be encoded with colors for visualization.

14614 **(SFB—210/T-8) Flow and resistance characteristics of walls in turbulent boundary layer flows.** Rau, M.; Friedrich, R.; Plate, E. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich 210 Stroemungsmechanische Bemessungsgrundlagen fuer Bauwerke). Sep 1985. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE87751258.

The authors review the methods presented in relevant publications for calculating the velocity fields of subsectors, e.g. boundary layers along a plane wall disturbed by a plate, and describe the resistance coefficient. The problems are presented in chronological order using an extensive bibliographic survey.

14615 **(UCID—20957) On the artificial viscosity in 1D spherical geometry.** Crowley, W.P. (Lawrence Livermore National Lab., CA (USA)). 7 Jan 1987. Contract W-7405-ENG-48. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004449.

An artificial viscosity formulation based on the conservation equations for viscous compressible hydrodynamics is considered. The method uses tensor analysis to properly transform Richtmyer and von Neumann's artificial viscosity to non-planar geometries. It will be shown that the naive replacement of p by p+q in the Cartesian equations leads to poor results when these equations are used in spherical geometries. In section 2 the viscous equations of motion for 1D spherical geometry are discussed. Section 3 the difference equations for momentum and energy are derived. In sections 4 and 5 the two viscosity coefficients, μ and λ, are discussed. In section 6 describes computational results. Appendix A contains the tensor formulation and Appendix B shows the equations for cylindrical geometry. 4 refs., 7 figs.

14616 **Polydispersity in fluids and composites: some theoretical results.** Stell, G.; Rikvold, P.A. (SUNY, Stony Brook, NY). *International Journal of Thermophysics;* **7**: No. 4, 863-876(Jul 1986). (CONF-850617—).

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

The effect of polydispersity in particle size on the structure of a solution or suspension of hard spheres in a continuum solvent is considered, with emphasis on the leading concentration corrections to ideal behavior on the pair distribution function and equation of state. Polydispersity in dispersions of randomly centered spherical particles and parallel cylindrical particles with randomly placed axes is also considered.

14617 **Shear-induced phase changes in mixtures.** Romig, K.D.; Hanley, H.J.M. (Univ. of Colorado, Boulder, CO). *International Journal of Thermophysics;* **7**: No. 4, 877-886(Jul 1986). (CONF-850617—).

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

A thermodynamic theory to account for the behavior of liquid mixtures exposed to a shear is developed. One consequence of the theory is that shear-induced phase changes are predicted. The theory is based on a thermodynamics that includes specifically the shear rate in the formalism and is applied to mixtures by a straightforward modification of the corresponding states, conformalsolution approach. The approach is general but is used here for a mixture of Lennard-Jones particles with a Lennard-Jones equation of state as a reference fluid. The results are discussed in the context of the Scott and Van Konynenberg phase classification. It is shown that the influence of a shear does affect substantially the type of the phase behavior. Results from the model mixture are equated loosely with those from real polymeric liquids.

14618 **Calculation of the mutual diffusion coefficient by equilibrium and nonequilibrium molecular dynamics.** Erpenbeck, J.J.; Kincaid, J.M. (Los Alamos National Lab., Los Alamos, NM). *International Journal of Thermophysics;* **7**: No. 2, 305-317(Mar 1986). (CONF-850617—).

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

A nonequilibrium molecular dynamics method for the calculation of the mutual diffusion coefficient for a mixture of hard spheres is described. The method is applied to a 50-50 mixture of equidiameter particles having a mass ratio of 0.1 for the two species, at a volume of three times close-packing. By extrapolating the results to the limit of vanishing concentration gradient and infinite system size, we obtain a value in statistical agreement with the result obtained using a Green-Kubo molecular dynamics procedure, which is also described. The nonequilibrium calculation yields a mutual diffusion coefficient which decreases slightly with increasing concentration gradient. The Green-Kubo timecorrelation function for mutual diffusion displays a slow decay with time, qualitatively similar to the long-time tail which has been predicted by the hydrodynamic theory of Pomeau.

14619 **Forced modes of dilute binary gas mixtures.** Kamgar-Parsi, B.; Cohen, E.G.D. (Rockefeller University New York, NY). *International Journal of Thermophysics;* **7**: No. 2, 395-405(Mar 1986). (CONF-850617—).

From 9. symposium on thermophysical properties; Boulder, CO, USA (24 Jun 1985).

Anomalous forced sound dispersion in dilute binary gas mixtures is studied as a function of the mass ratio of the two components, using one- and two-temperature theories as well as different interparticle potentials. For a disparatemass mixture, such as He-Xe, the results are compared with previous work due to Johnson et al. It is suggested that even for nondisparate-mass mixtures, a one-temperature treatment is not appropriate.

14620 **Application of parquet perturbation theory to ground states of boson systems.** Jackson, A.D. Lande, A.; Guitink, R.W.; Smith, R.A. (State Univ. of New York, Stony Brook). *Physical Review* [*Section*] *B: Condensed Matter;* **31**: No. 1, 403-415(1 Jan 1985). Contract AC02-76ER13001.

In the interest of polishing the parquet approach to microscopic calculations of ground-state properties of zero-temperature quantum fluids, the authors have developed a perturbative scheme for the systematic improvement of the four-point function which retains the correct behavior of the parquet diagrams in both the small-r and small-k limits. Numerical implementation of this scheme indicates significantly improved agreement with binding energies calculated with Green's-function Monte Carlo techniques (i.e., differences in liquid ^{4}He are less than 1.5%). The charged Bose gas and the hard-sphere system are also considered. Remaining difficulties in the calculations of the liquid structure function are noted and discussed. 12 references, 8 figures, 5 tables.

14621 **Solitons in a wave tank.** Olsen, M.; Smith, H.; Scott, A.C. (Orsted Institute, Copenhagen, Denmark). *American Journal of Physics;* **52**: No. 9, 826-830(Sep 1984).

A wave tank experiment (first described by the nineteenth-century engineer and naval architect John Scott Russell) relates a linear eigenvalue problem from elementary quantum mechanics to a striking feature of modern nonlinear wave theory: multiple generation of solitons. The tank experiment is intended for lecture demonstrations. 19 references, 6 figures.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 14693

14622 (DOE/ER/03071—22) [Conduct theoretical and experimental research programs in high energy physics]: Technical progress, Appendix A-2, FTP/A, Item 20,f. (Pennsylvania Univ., Philadelphia (USA)). 1 Apr 1986. Contract AC02-76ER03071. 91p. NTIS, PC A05/MF A01. File Number DE87004793.

Progress is reported in these areas: neutrino physics; nucleon decay and the intrinsic properties of neutrinos; the D-zero experiment; QCD jet physics and ultrarelativistic nuclear physics; the Colliding Detector at Fermilab; rare kaon decay; the Anomalous Single Photon detector at SLAC; particle theory; neutrino astrophysics and cosmology; and operations and support services. (LEW)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 14707, 14857, 14858

14623 (ANL-HEP-CP—86-124) Nonaccelerator physics working group summary. Ayres, D.S.; Beier, E.W.; Cherry, M.L.; Marciano, W.J. (Argonne National Lab., IL (USA); Pennsylvania Univ., Philadelphia (USA); Brookhaven National Lab., Upton, NY (USA)). 1986. Contract W-31-109-ENG-38. 7p. (CONF-8606215—32). NTIS, PC A02. File Number DE87004969.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

The Nonaccelerator Physics Working Group set itself the task of predicting the contributions of nonaccelerator experiments to particle physics during the 1990s, in order to assess the needs for new experimental facilities. The main topics studied by the subgroups were: (1) the possibility of doing particle physics experiments with high energy cosmic rays from astrophysical sources; (2) the prospects for experiments which seek to measure the masses of neutrinos and the mixing of neutrino flavors; (3) an examination of the implications for proton decay of recent theoretical developments in grand unified and string theories. Other topics included a survey of magnetic monopole searches, an assessment of future prospects for double-beta-decay and nucleon-decay experiments, and a review of recent progress on neutrino and dark-matter detectors based on quasiparticles in superconductors and phonons in crystals.

14624 (CONF-8606241—3) Introducing the working group on excited baryons at the CEBAF 1986 workshop. Mukhopadhyay, N.C. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Physics). 1986. Contract AC02-83ER40114. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003925.

From 3. Continuous Electron Beam Accelerator Facility summer school; Newport News, VA, USA (23 Jun 1986).

Several important issues related to excited baryons are outlined. These include the questions of why to study electromagnetic excitation of baryons, which excited baryons to study, and what new physics to expect. Also considered are amplitude ambiguities for γBB^* and theoretical problems of extracting the resonant amplitude. Excited baryons in nuclei and future experiments are considered. (LEW)

14625 (DOE/ER/10587—T3) Work to measure the decay parameters in polarized $\Sigma p \rightarrow ne\ nu$ with high precision: Progress report for period May 1, 1986-April 30, 1987. Winston, R. (Chicago Univ., IL (USA). Dept. of Physics). Dec 1986. Contract AC02-80ER10587. 4p. NTIS MF A01; 2; GPO Dep. File Number DE87004299.

Progress is reported in the beta decay of polarized sigma-minus, including analysis of form factors and magnetic moments. Also reported is work in an experiment to measure CP violation in the decay K/sub L/$\rightarrow 2\pi$/sup O/. (LEW)

14626 (DOE/ER/40030—3) Medium energy measurements of n-n parameters: Progress in research, January 1, 1986-December 31, 1986. Riley, P.J. (Texas Univ., Austin (USA). Dept. of Physics). Jan 1987. Contract AS05-81ER40030. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004410.

A major part of the work has been and will continue to be associated with research done at the Nucleon Physics Laboratory (NPL) at the Los Alamos Meson Physics Facility (LAMPF). The aim of the experimental program is the determination of the nucleon-nucleon amplitudes at medium energy. The required data include both elastic and inelastic experiments, and in addition the measurement of polarization and polarization transfer parameters. We have been emphasizing single pion production measurements using polarized proton beams, and expect that our present data base will provide stringent tests of theoretical models. With the development of the LAMPF high intensity polarized proton source, we expect that a reasonably intense beam of medium energy polarized neutrons will become available, and are planning a series of experiments utilizing polarized neutrons to determine the importance of the I = 0 reaction amplitudes at medium energies.

14627 (INIS-mf—10556-Vol.1, pp 274) Heavy flavour production in hadron collisions. Geist, W.M. (European Organization for Nuclear Research, Geneva, Switzerland). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE87700737. (CONF-8408138—Vol.1).

From 6. general conference of the European Physical Society; Prague, Czechoslovakia (27 Aug 1984).

14628 (INIS-SU—392, pp 234) Restriction on the mixing parameter of electron and massive neutrinos from the data on the superallowed 0/sup +/ -> 0/sup +/ β-transitions of Fermi type. Isakov, V.I.; Strikman, M.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14629 (KEK—85-4, pp 41-67) Neutrino mass experiment. Yasuda, Takahiro. (Tokyo Univ., Tanashi, Japan. Inst. for Nuclear Study). Aug 1985. NTIS (US Sales Only), PC A09/MF A01. File Number DE87780045. (CONF-8411278—).

From Toward unification and its verification workshop; Takayama, Gifu, Japan (15 Nov 1984).

The principle of the neutrino mass measurement is reviewed with particular emphasis on the problem of energy resolution. A brief review is also given for the ITEP group's experiment in 1984 and other past and future scheduled experiments in the world. These include; FNAL-Rockefeller-Lawrence Livermore group, Los Alamos group, Zurich group, and Stockholm group. The detail of the experiment of the author's group, INS (Institute for Nuclear Study, University of Tokyo), is also presented in some length. In the present experiment, very thin β sources were obtained in which the electron energy loss was reduced by a factor of two compared with that of the ITEP group. One of the features of this experiment is an excellent energy resolution of 5 - 7 eV. "No energy loss" peak was clearly observed in the KL/sub 2/L/sub 3/ Auger spectrum (18.5 KeV). The ratio of the number of events with and without energy loss increases with the thickness of the source. In case of the two layer source, it is about 13 %. The resolution of the spectrometer was obtained using this sharp peak, which was $\Delta p/p$ = 0.0256 % (ΔE = 9.3 eV) compared with the ($\Delta p/p$) = 0.060 % (ΔE = 22.3 eV) of the ITEP group. (Aoki, K.).

14630 (LBL—22392) The hydrogen bubble chamber and the strange resonances. Alvarez, L.W. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 13p. (CONF-8506332—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003546.

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

The author's recollections of his experience in the use of bubble chambers and the discoveries of strange resonances are given. (LEW)

14631 **(LBL—22579) Measurement of the inclusive branching fraction tau⁻ → nu/sub tau/$\pi^-\pi^0$ + neutral meson(s).** Moses, W.W. (California Univ., Berkeley (USA)). Dec 1986. Contract AC03-76SF00098. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE87004592.

This dissertation measures an inclusive branching fraction of (13.9 +- 2.0/sub -2.4//sup +2.1/)% for the decay tau⁻ → nu/sub tau/$\pi^-\pi^0$ + nh⁰ where h⁰ is a π^0 or an eta and n ≧ 1. The data sample, obtained with the TPC detector facility at PEP, corresponds to an integrated luminosity of 72 pb^{-1} at 29 GeV center of mass energy. The measured value for this branching fraction is somewhat greater than the theoretical prediction and, taking errors into account, resolves the present difference between the inclusive and the sum of the exclusive tau⁻ branching fractions into one charged prong. In addition, a lower limit of 8.3% (95% CL) is placed on the branching fraction B(tau⁻ → nu/sub tau/$\pi^-\pi^0\pi^0$).

14632 **(SLAC—307) A search for narrow states in radiative upsilon decays.** Lowe, S.T. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1986. Contract AC03-76SF00515. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004489.

A search for new states produced in radiative Y(1S) decays is accomplished by observing the inclusive photon energy spectrum. A narrow resonance in the energy spectrum indicates the existence of a new state X produced by the process Y → γX. The analysis is based on approximately 0.44 x 10^6 Y(1S) events produced at the DORIS II e^+e^- storage ring. These data were collected with the Crystal Ball detector between April 1983 and May 1986. This analysis finds no evidence for a new state, so upper limits on the branching ratio BR(Y → γX) are derived, assuming the state X decays primarily to high-multiplicity hadronic final states. In particular, if the state X were a minimal Higgs particle, its primary decay mode would be to the heaviest fermion-antifermion pair energetically available. For the radiative Y(1S) decays studied here, the heavy fermions would be c anti c or s anti s quark states, over most of the relevant Higgs' mass range. The resulting upper limit for BR(Y(1S) → γX) is highly energy dependent but for X mass between 1.5 GeV and 8.0 GeV, the 90% confidence level upper limit is better than 8.0 x 10^{-4}. For a Higgs' mass near 5.0 GeV, the upper limit is about 2.0 x 10^{-4} which is approximately equal to the lowest order calculation for the Wilczek mechanism. The Wilczek calculation with QCD radiative corrections predict branching ratios below the limits set here for all Higgs' masses.

14633 **(SLAC-PUB—4139) Spectroscopy of light and heavy quarks.** Cooper, S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1986. Contract AC03-76SF00515. 36p. (CONF-860701—68). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004567.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

New results on various controversial light mesons are reviewed, including the glueball candidates f_2(1720) and eta(1460), the 1^{++}-0^{-+} mass "coincidences" f_1(1285)-eta(1275) and f_1(1420)-eta(1420), as well as evidence for the X(3100)→Λanti p+nπ and the rho(1480)→phi π, which have quantum numbers not allowed for q anti q. The γγ→VV effects move out of the threshold region with data on γγ→ωrho. Statistically weak data on Γ/sub γγ/eta/sub c/ and the search for heavy quark P_1 states are presented. Γ/sub ee/, B/sub μμ/, and Γ/sub tot/ for the Y(1S), Y(2S), and Y(3S) are updated using new data and a consistent treatment of the radiative corrections for Γ/sub ee/. New data on the mass splittings of the chi/sub b/(2P) compare favorably with the scalar confinement model, which may however have new trouble. 150 refs., 43 figs.

14634 **(TRI-PP—86-83) Recent searches for lepton flavor violation.** Bryman, D. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1986. 4p. (CONF-860701—67). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900327.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

No process which does not conserve lepton number has been observed. However, since this empirical information is incorporated in the standard model in an ad hoc fashion, searches for reactions which exhibit lepton flavor violation (LFV) may lead to new approaches or new constraints to further development. In this paper, limits from searches for muon-electron and muon-positron conversion in the field of a nucleus and for reactions μ → eX where X is a weakly interacting boson are discussed. A summary of the status of LFV searches is given.

14635 **Observation of a 1750 MeV narrow meson decaying into etaeta.** Alde, D.; Knapp, E.A.; Binon, F.; Bricman, C.; Lagnaux, J.P.; Mouthuy, T.; Stroot, J.P.; Donskov, S.V.; Inyakin, A.V.; Kachanov, V.A. (Los Alamos National Lab., NM, USA; Institut Interuniversitaire des Sciences Nucleaires, Brussels, Belgium). *Physics Letters [Section] B;* **182**: No. 1, 105-107(11 Dec 1986).

A narrow meson which decays into etaeta is observed in 38 GeV/cπ/sup -/p collisions at large momentum transfer. The experiment has been performed at the Serpukhov accelerator with the GAMS-2000 spectrometer. The mass of this new meson is (1755+-8) MeV, its width is less than 50 MeV. Its spin-parity is J/sup PC/=0/sup ++/ or less probably 2/sup ++/.

14636 **Experimental status of proton decay.** van der Velde, J.C. (Physics Dept., Univ. of Michigan, Ann Arbor, MI). pp 615-638 of Proceedings of the first Aspen winter physics conference. Block, M.M. New York, NY; The New York Academy of Sciences (1986). (CONF-850146—).

From Aspen winter physics conference; Aspen, CO, USA (14 Jan 1985).

Atmospheric neutrino interactions have been recorded in several of the "modern" nucleon decay detectors. The rate of detected events is about as expected: ≈100 events/kt-yr with E/sub vig/ > 0.2 GeV. There are approximately five events/kt-yr that have ≧ two fairly wide-angle tracks and that fall into the general category of nucleon decay "candidates." Wide-angle (>150°) two-track events with ΔP ≦ 200 MeV/c (the "classic" proton decay topology) do occur at a rate of ≈ one event/kt-yr. At this point, there is no good evidence that such events are inconsistent with the background; the rate is approximately as expected. Using the above numbers and adding some reasonable estimate of the background to be subtracted, one gets the following general limits: If P → "classic" modes, then tau/sub p/ ≧ 5 x 10 10/sup 32/ yr; If P → ν dominated modes, then tau/sub p/ ≧ 5 x 10/sup 31/ yr. If nucleon decays are hiding in the "neutrino curtain" then there is going to be a lot of hard work digging them out. One helpful clue should be the dominance of a single decay mode.

14637 **New physics results from UA1.** Rohlf, J. (Harvard Univ., Cambridge, MA 02138). pp 151-168 of Fifth workshop on grand unification. Kang, K.; Fried, H.; Frampton, P. Singapore; World Scientific Pub. Co. Pte. Ltd. (1984). (CONF-8404155—).

From 5. workshop on grand unification; Providence, RI, USA (12 Apr 1984).

New results are presented from experiment UAl at the CERN collider (proton-antiproton collisions at a center-of-mass energy of 540 GeV). The main part of this report is concerned with the observation of events with large missing transverse energy. The authors describe the event selection. Events are observed with a single electromagnetic cluster and a single hadronic jet. Other recent results on dimuon events and charmed particle production are mentioned briefly. The authors have observed five clean single jet events and one clean "photon" event with missing transverse energy greater than 40 GeV. They have no explanation for these events in term of backgrounds or standard model physics. The authors believe that they are due to new physical processes. More data are desperately needed to determine their origin. Some sign dilepton events have been observed at the collider. The charmed quark is copiously produced in (presumably gluon) jet fragmentation at the collider.

14638 Rare particles. Kutschera, W. (Argonne National Lab., IL). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **B5**: 420-425(1984). Contract W-31-109-ENG-38.

The use of accelerator mass spectrometry (AMS) to search for hypothetical particles and known particles of rare processes is discussed. The searched for particles include fractionally charged particles, anomalously heavy isotopes, superheavy elements, doubly charged negative ions, solar neutrinos, and spontaneous emission of ^{14}C from ^{223}Ra. 35 references, 3 figures.

14639 Results from a hadron jet experiment at $\sqrt{s}$ = 19.4 and 27.4 GeV. Arenton, M.W.; Chen, H.F.; Corcoran, M.; Cormell, L.R.; Ditzler, W.R.; Dris, M.; Erwin, E.R.; Fields, T.; Fleischman, J.; Gardell, E.; Gustafson, R. (Argonne National Lab., IL). pp 507-514 of Proceedings of the Santa Fe meeting. Goldman, T.; Nieto, M.M. (eds.). Philadelphia, PA; World Scientific (1984).

From Proceedings of the Santa Fe meeting; Santa Fe, NM, USA (31 Oct-3 Nov 1984).

In Fermilab experiment E609 the authors have studied the production of high P/sub t/ hadron jets by beams of protons at 200 and 400 GeV/c and pions at +/- 200 GeV/c. Results for the single-jet and di-jet cross sections are given and are compared to QCD predictions. Leading-particle charge ratios from di-jet events are given and compared to QCD-motivated predictions. Evidence is presented concerning a higher twist effect in π p interactions as predicted by Berger and Brodsky. Preliminary results on high transverse energy events from nuclear targets are given. Finally, they present comparisons of their pp high E/sub t/ data with predictions from two Monte Carlo models.

14640 Asymmetric operation of the SSC - its effect on jet production. Kanofsky, A. (Lehigh Univ., Bethlehem, PA). pp 637-638 of Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider. Donaldson, R.; Morfin, J.G. (eds.). Washington, DC; American Physical Society (1984). Contract AC02-76ER02894.

From Proceedings of the 1984 summer study on the design and utilization of the superconducting super collider; Snowmass, CO USA (23 Jun-13 Jul 1984).

The author calculates the asymmetric cross sections for production of jet pairs and discuss the benefits of such operation on determining various physical quantities such as the structure functions. He calculates to first order in QCD perturbation theory the production of quark jet pairs and how asymmetric beam operation affects the measurements of various observables such as the structure functions. In particular, he is interested in determining whether accurate structure functions can be obtained at low values of x for the case of asymmetric beam energy operation - i.e., if asymmetric operation makes kinematic regions accessible that otherwise wouldn't be.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 14624, 14633, 14662, 14680, 14953, 15015, 15016

14641 (CEA-CONF—8438) Superstring phenomenology. Cohen, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Mar 1986. 10p. (CONF-8603119—13; CEA-SPhT—86-051). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750776.

From 21. Rencontre de Moriond: strong interactions and gauge theories conference; Les Arcs, France (16 Mar 1986).

A brief general review of string and superstring theories of phenomenological interest is presented. It is intended mainly for the experimentalists.

14642 (CONF-860701—69) Sigma minus form factors and magnetic moment. Winston, R. (Chicago Univ., IL (USA)). 1986. Contract AC02-82ER40073. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004579.

From 23. international conference on high-energy physics; Berkeley, CA, USA (16 Jul 1986).

We report results from a Fermilab polarized Sigma minus decay experiment. From a sample of 50,000 beta decays and 10^6 two body decays with polarization parallel to the magnetic field we have extracted the semi-leptonic form factors. From another sample of 21,000 beta decays and 650,000 two body decays where the polarization precessed in the magnetic field we have measured the magnetic moment.

14643 (CONF-8606241—4) Excited baryons. Mukhopadhyay, N.C. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Physics). 1986. Contract AC02-83ER40114. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003926.

From 3. Continuous Electron Beam Accelerator Facility summer school; Newport News, VA, USA (23 Jun 1986).

The status of the theory of the low-energy approach to hadron structure is reviewed briefly by surveying a few relevant models. A few examples of tests needed to sort out the predictions of different models pertaining to the quark-gluon structure of hadrons are discussed, and given the resulting physics objectives, a few experimental options for excited baryon research at CFBAF are suggested. (LEW)

14644 (DOE/ER/40200—043) High energy photoproduction of W-bosons. Kallianpur, K.J. (Texas Univ., Austin (USA). Center for Particle Theory). Mar 1986. Contract FG05-85ER40200. 25p. NTIS, PC A02. File Number DE87004327.

The cross sections and energy and angular distributions are calculated for the reactions $\gamma + n \rightarrow W^- + p$ and $\gamma + p \rightarrow W^+ + n$. Weak and electromagnetic form factors are used and an anomalous magnetic moment κ of the W-boson is included. We give results for the values $\kappa = 1, 0, -1$.

14645 (DOE/ER/40200—053) A correction to the width of heavy Higgs bosons: An addendum to radiative decay of heavy Higgs bosons. Dicus, D.A.; Willenbrock, S.D.; Imbo, T.D.; Keung, W.Y.; Rizzo, T.G. (Texas Univ., Austin (USA). Center for Particle Theory; Illinois Univ., Chicago (USA). Dept. of Physics; Iowa State Univ. of Science and Technology, Ames (USA)). Apr 1986. Contract W-7405-ENG-82;FG02-84ER40173;FG05-85ER40200. 11p. NTIS, PC A02. File Number DE87004328.

We determine the width for radiative decay of heavy Higgs bosons $H \rightarrow W^+ W^- \gamma$ for hard photons as a function of the Higgs boson mass and the photon-energy cutoff, and correct the result of a previous calculation.

14646 (DOE/ER/40200—083) Determination of the LAMBDA magnetic moment by QCD sum rules. Pasupathy, J.; Singh, J.P.; Chiu, C.B.; Wilson, S.L. (Texas Univ., Austin (USA). Center for Particle Theory; Indian Inst. of Science, Bangalore. Centre for Theoretical Studies). 24 Nov 1986. Contract FG05-85ER40200. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004390.

The magnetic moment of the Λ-hyperon is calculated using the QCD sum rule approach of Ioffe and Smilga. In deriving the sum rules special attention is paid to the strange quark mass dependent terms and to several additional terms not considered in earlier works. These terms are not appropriately incorporated. The sum rule is analyzed using the ratio method. Using the external field induced susceptibilities determined earlier, we find that the calculated value of μ/sub Λ/ is in agreement with experiment.

14647 (INIS-SU—392, pp 273) On the analysis of non-diagonal lepton processes with account for the neutrino mass. Gnedov, Yu.A.; Romanov, Yu.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14648 (INIS-SU—392, pp 272) **Investigation of pairing spin correlations of electrons, positrons and γ quanta in the Esup(+)esup(-) pair photoproduction process on nuclei with account for recoil effects and nuclear structure.** Nadzhafov, I.M.; Rustamova, G.R.; Radzhabov, M.R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14649 (INIS-SU—392, pp 428) **Potential description of two hadron interaction with accounting for their quark structure.** Petrov, N.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14650 (INIS-SU—392, pp 435) **P matrix description of two strongly interacting charged particles.** Babenko, V.A.; Petrov, N.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14651 (JINR—R-2-85-667, pp 84-91) **On a possibility of gravitational wave detection by means of vacuum quantum effects.** Mamaev, S.G.; Mostepanenko, V.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad, USSR). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Effect of a gravitational wave on vacuum of light scalar particles is discussed. Basic results on production of scalar pairs by periodic electric field are presented. The effect of scalar pair production in the field of a gravitational wave is estimated. The effect of pair production becomes noticeable after two weeks of observations for a typical source of gravitational waves namely double star comprising black holes with mass of order of solar one at the distance of 10/sup 3/ km from one another. If an observer is at the distance of 1 kpc, the required time grows by 11 orders.

14652 (JINR—R-2-85-667, pp 151-156) **Mesons and baryons in the gravitational field.** Shavokhina, N.S. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Meson and baryon behaviour in a gravitational field is discussed. Mesons and baryons are relativistic systems of two and three bodies called quarks. Within the frames of the general relativity theory the quark system in an external gravitational field is described by a boundary-value problem for two- or three-dimensional surface in curved (Riemann) space-time. Within the frames of the relativistic gravitation theory a gravitational field is considered as a tensor one in plane space-time. Description of the quark system in external gravitational fields is shown to be different in the general relativity and relativistic gravitation theories.

14653 **(LBL—22497) Signals for supersymmetry at the SSC [Superconducting Super Collider].** Barnett, R.M. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 18p. (CONF-8606215—29). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004591.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

Progress is reviewed in setting mass limits for supersymmetric particles. Since missing energy is a prime signal for supersymmetry, we have calculated several sources of "fake" missing energy in ordinary events. The techniques for finding squark-squark and gluino-gluino production are examined and constrasted for $\sqrt{s}$ = 0.63, 2, and 40 TeV; methods of reducing backgrounds are described. The branching ratios of scalar quarks to the lightest supersymmetric particle are calculated with full gaugino mixing. We have considered signals and backgrounds involving hard photons from photino decay and other sources. The process H $\rightarrow$ H $\rightarrow$ Higgsino^0 zino^0 with H $\rightarrow$ Higgsino^0 $\rightarrow$ gamma photino and zino^0 $\rightarrow$ ee photino was examined in detail and found to have few backgrounds, and to provide a means of detecting a heavy Higgs particle. The direct production of charginos and neutralinos was calculated. Gluinos are considered as constituents of the proton.

14654 **(SLAC-PUB—4127) O(α2)W mass shift from a very heavy top quark.** Lynn, B.W.; Kennedy, D.; Verzegnassi, C. (Stanford Univ., CA (USA); Trieste Univ. (Italy). Dipartimento di Fisica Teorica; Istituto Nazionale di Fisica Nucleare, Trieste (Italy); International School of Advanced Studies, Trieste (Italy)). Oct 1986. Contract AC03-76SF00515. 4p. (CONF-8609223—1). NTIS, PC A02/MF A01. File Number DE87003266.

From ECFA workshop: LEP 200; Aachen, F.R. Germany (29 Sep 1986).

Oblique correction contributions to the W mass involving the various vacuum polarizations in a renormalization scheme independent way has been done starting from a general approach which evaluates higher order corrections. The specific case of the heavy top corrections on the order of α^2 to the precise W mass is considered. It is concluded that effects on the order of α^2 are negligible even at a level of accuracy of 50 MeV. 7 refs. (LEW)

14655 **Signals for exotic quark production at hadron colliders.** Rizzo, T.G. (Ames Lab., IA, USA; Iowa State Univ. of Science and Technology, Ames, USA. Dept. of Physics). *Physics Letters [Section] B;* **181**: No. 3/4, 385-387(4 Dec 1986). Contract W-7405-ENG-82.

We consider the possibility of detecting the exotic D quarks present in E/sub 6/ theories at high energy hadron colliders (particularly the Superconducting Super Collider - SSC). The cleanest decay signature for a Danti D pair involves two jets plus four charged leptons and is essentially background free. We show that D masses at high as $\simeq$ 2 TeV may be accessible in this manner.

14656 **Time dependences of Skyrmion.** Liu, K.F.; Zhang, J.S. (Dept. of Physics and Astronomy, Univ. of Kentucky, Lexington, KY 40506). pp 103-114 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The small oscillation of the static Skyrmion is considered. It is found first of all that the Skyrmion is stable against small oscillations and there is no bound state. The meson-soliton scattering phase shift if calculated. A resonance is found at $\approx$ 250 -300 MeV above the nucleon which is only half way from the Roper resonance N(1440). Small oscillations are also considered for the spinning Skyrmions. The results are similar. Some implications and difficulties associated with this approach are pointed out.

14657 **Anomalies, vector mesons and the omega $\rightarrow$ 3π contact term.** Rudaz, S. (Univ. of Minnesota, Minneapolis). *Physics Letters [Section] B;* **145B**: No. 3-4, 281-284(20 Sep 1984). Contract AC02-82ER40051.

The requirement that the low-energy theorems of broken chiral symmetry be compatible with calculations based on effective vertices and vector-meson dominance leads to a number of relations among strong interaction quantities. Here the authors use this approach to determine the omega $\rightarrow$ 3π contact term, and comment on a number of recent investigations along these lines. 23 references.

14658 **Theories of fermion masses.** Bagger, J.; Raby, S.; Georgi, H.; Dimopoulos, S. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94305). pp 95-107 of Fifth workshop on grand unification. Kang, K.; Fried, H.; Frampton, P. Singapore; World Scientific Pub. Co. Pte. Ltd. (1984). (CONF-8404155—).

From 5. workshop on grand unification; Providence, RI, USA (12 Apr 1984).

The authors present grand unified theories in which the quark masses and mixing angles are calculated in terms of the lepton masses through simple group theory. The theories contain no small Yukawa couplings. A favored value of the top quark mass is 35 GeV. The authors have found a framework which allows them to compute the quark masses and mixing angles in terms of the lepton masses, using simple group theory. They have scanned about 10/sup 6/ models. The authors are presently looking through these models to find those whose Higgs structure is appealing, and whose dual Feynman diagrams follow from simple family symmetries. The favored prediction for the top quark mass is 35 GeV.

6453 Particle Invariance Principles And Symmetries

14659 **Witten index at finite temperature.** Das, A.; Kharev, A.; Mathur, V.S. (Argonne National Lab., IL, USA. High Energy Physics Div.; Rochester Univ., NY, USA. Dept. of Physics and Astronomy). *Physics Letters [Section] B;* **181**: No. 3/4, 299-304(4 Dec 1986). Contract AC02-76ER13065.

It is shown that the Witten index for a supersymmetric theory always vanishes at finite temperature and the thermal vacuum has nonvanishing energy supporting the earlier conclusion of Das and Kaku that supersymmetry is spontaneously broken at finite temperature. In a simple supersymmetric model it is shown that the supersymmetry charges fail to annihilate the thermal vacuum and the Goldstino states are constructed explicitly.

14660 **Simultaneity and reality of U(n) and SU(n) 3jm and 6j symbols.** Bickerstaff, R.P. (Univ. of Washington, Seattle). *Journal of Mathematical Physics (New York);* **25**: No. 10, 2808-2814(Oct 1984).

A simple proof is given of the simultaneous existence of a real set of 3jm and 6j symbols for the unitary groups U(n) and SU(n); including the case of mixed tensor representations. The authors observe that simultaneity is incompatible with the conventional permutation symmetries for U(n) with $n > 3$. The relevance of these results to the Schur-Weyl duality of U(n) with the symmetric groups S_l is discussed.

14661 **Scale of chiral symmetry breaking with l = 1 quarks in SU(2) gauge theory.** Kogut, J.; Shigemitsu, J.; Sinclair, D.K. (Univ. of Illinois, Urbana-Champaign). *Physics Letters [Section] B;* **138B**: No. 4, 283-286(19 Apr 1984). Contract AC02-76ER01545;AC02-76ER02978.

The authors obtain the ratio R_1/R/sub 1/2/ of chiral symmetry breaking scales for quarks in the l = 1 and l = 1/2 representations of SU(2). (psi vector psi) is computed for the zero temperature theory in the quenched approximation on a 10^4 lattice and the value R_1/R/sub 1/2/ = 1.6 +/- 1.0 is extracted. This result is consistent with a previous estimate of the ratio of relevant scales which compared the chiral symmetry restoration temperatures T_1 and T/sub 1/2/ for the two representations and found T_1/T/sub 1/2/ = 8.6 +/- 4.5. The new l = 1 data scales according to asymptotic freedom. 9 references, 3 figures.

6454 Field Theory

REFER ALSO TO CITATION(S) 14641, 14657, 14658, 15154

14662 **(BNL—38909) Proton decay theory.** Marciano, W.J. (Brookhaven National Lab., Upton, NY (USA)). Jun 1986. Contract AC02-76CH00016. 5p. (CONF-8606215—27). NTIS, PC A02. File Number DE87003482.

From Summer study on the physics of the superconducting super collider; Snowmass, CO, USA (23 Jun 1986).

An update is given of the gauge coupling values. The status of the original SU(5) Georgi-Glashow model predictions, which assume a great desert between m/sub W/ and m/sub X/, the unification mass scale, is described. Gauge boson mediated proton decay in the SU(5) model, and proton decay via Higgs scalars are discussed. The inclusion of supersymmetry is grand unified theories and the relation of dimension 5 operators to proton decay are discussed briefly. 14 refs. (LEW)

14663 **(CONF-8607105—1) Super Riemann surfaces.** Rabin, J.M. (Chicago Univ., IL (USA)). Oct 1986. Contract AC02-82ER40073. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004499.

From Conference on mathematical aspects of string theory; San Diego, CA, USA (21 Jul 1986).

A mathematically rigorous notion of supermanifold is presented and used to develop the theory of super Riemann surfaces. Super Riemann surfaces describe superconformal equivalence classes of supergravity geometries in two dimensions and therefore provide a powerful formalism for studying fermionic string theory. They also provide a convenient description of spin structures and half-forms on ordinary Riemann surfaces. I prove the uniformization theorem for super Riemann surfaces, determine the dimension and global structure of super Teichmueller space, and show that the super modular group is isomorphic to the ordinary modular (mapping class) group. Quasisuperconformal mappings and the super Beltrami equations are briefly discussed. 32 refs.

14664 **(DOE/ER/40153—3) Research in particle theory: Annual progress report for the period January 1, 1986-December 31, 1986.** Mansouri, F.; Suranyi, P. (Cincinnati Univ., OH (USA)). Dec 1986. Contract FG02-84ER40153. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004132.

Superstring compactification schemes are considered, in which the vacuum gauge field configurations are not an embedding of the spin connection but have the same second Chern class. They permit N = 1 supersymmetry in four dimensions and gauge groups such as SO(10) and SU(5). A new and much improved formulation of parastring theories is given. It is shown that they are consistent with Lorentz invariance, unitarity, and modular invariance in appropriate critical dimensions. The regularization of their zero point fluctuations provides an alternative derivation of the critical dimensions. Non-abelian bosonization of free parafermion theories in two dimensions were carried out. Monte Carlo Renormalization Group method is used to find the correlation exponent in the finite temperature deconfining phase transition in SU(2) gauge theory. The exponent is in agreement with that of the ferromagnetic transition of the three dimensional Ising model. Exact bounds are found for the phase transition curve in the noncompact U(1) gauge-Higgs theory on a lattice.

14665 **(DOE/ER/40200—056) Strings reinterpreted as topological elements of space time.** Ne'eman, Y. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). 1986. Contract FG05-85ER40200. 15p. (TAUP/N—173-86). NTIS, PC A02. File Number DE87004330.

In 1974, Scherk and Schwarz suggested a reinterpretation of string dynamics as a theory of quantum gravity with unification. We suggest completing the transition through the reinterpretation of the strings themselves as Feynman-paths, spanning the topology of space time in the Hawking-King-McCarthy model. This explains the emergency of gravity.

14666 **(DOE/ER/40200—057) Spinors for superstrings in a generic curved space.** Ne'eman, Y.; Sijacki, D. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences; Belgrade Univ. (Yugoslavia). Inst. za Fiziku). 1986. Contract FG05-85ER40200. 17p. (TAUP/N—174-86). NTIS, PC A02/MF A01. File Number TI87004331.

The embedding of the superstring in a generic curved space involves the use of world-spinors behaving according to the (infinite) unitary representations of anti SL(10,R), the double-covering of the linear group on R^{10}. We provide the necessary construction and Lagrangian.

14667 **(DOE/ER/40200—058) Superstrings in a generic supersymmetric curved space.** Ne'eman, Y.; Sijacki, D. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences; Belgrade Univ. (Yugoslavia). Inst. za Fiziku). 1986. Contract FG05-85ER40200. 15p. (TAUP/N—175-86). NTIS, PC A02. File Number DE87004332.

Supersymmetry (off-shell) is necessary and sufficient for the preservation of the value of the critical dimension and the cancella-

tion of anomalies when the superstring is embedded in a generic curved space. This is achieved by embedding the doubly-covered general linear (spinorial curved space) group anti GL(10,R) in anti GQ(10,R), a non-simple real form derived from the exponentiation of the hyperexceptional superalgebra q(10).

14668 **(DOE/ER/40200—059) Double covering of diffeomorphisms for superstrings in generic curved space.** Ne'eman, Y.; Sijacki, D. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences; Belgrade Univ. (Yugoslavia). Inst. za Fiziku). 1986. Contract FG05-85ER40200. 18p. (TAUP/N—176-86). NTIS, PC A02. File Number DE87004333.

The embedding of the superstring in a generic curved space involves the use of world-spinors behaving according to the (infinite) unitary representations of SL-bar(10,R), the double-covering of the linear group on R^{10}. A supersymmetric extension is provided by the embedding of GL-bar(10,R) in the supergroup GQ-bar(10,R) whose flat limit reproduces Poincare supersymmetry.

14669 **(DOE/ER/40200—060) Internal supergroup prediction for the Goldstone-Higgs particle mass.** Ne'eman, Y. (Texas Univ., Austin (USA). Center for Particle Theory; Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). 1986. Contract FG05-85ER40200. 9p. (TAUP/N—177-86). NTIS, PC A02. File Number DE87004334.

Using a seemingly ad-hoc but phenomenologically fitting global internal supersymmetry SU(2/1) superset SU(2) x U(1) constraining the weak-electromagnetic otherwise arbitrary parameters, we predict for the Goldstone-Higgs particle a mass m/sub H/ = 2m/sub W/ or 160 to 170 GeV.

14670 **(DOE/ER/40200—077) Finite-energy classical solutions to Yang-Mills theories.** Mahajan, S.M.; Valanju, P.M. (Texas Univ., Austin (USA)). Oct 1986. Contract FG05-85ER40200. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004391.

Finite energy, spatially localized, static chromomagnetic solutions to classical Yang-Mills theories are derived and discussed.

14671 **(DOE/ER/40200—078) Strings: From hadron dual models to gravity, unification and the structure of space-time.** Ne'eman, Y. (Texas Univ., Austin (USA); Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). 1986. Contract FG05-85ER40200. 31p. (TAUP/N—178-86). NTIS, PC A03/MF A01. File Number DE87004388.

We review the evolution of the second-quantized superstring, from its birth as a theory of the hadron bootstrap to its present status as a candidate theory of Quantum Gravitational Dynamics (QGD) and Super-unification. 46 refs.

14672 **(DOE/ER/40200—082) Superstrings and covariance in the embedding manifold.** Ne'eman, Y. (Tel Aviv Univ. (Israel). Sackler Faculty of Exact Sciences). 1986. Contract FG05-85ER40200. 10p. (TAUP/N—179-86). NTIS, PC A02/MF A01; GPO Dep. File Number DE87004389.

The superstring R^2 world-sheet (coordinate zeta) is plunged into a generic curved 10-dimensional manifold through the replacement of the Lorentz vector and spinor frames X/sup m/(zeta), θ/sup a/(zeta) by infinite frames X/sup M-tilde/(zeta,chi), θ/sup A-tilde/(zeta,chi) supporting irreducible representations of the double-covering anti GL(10,R) and diffeomorphisms. These frames are further embedded in an irreducible representation of anti GQ(10,R), a supergroup containing the stability subgroups of flat-space supersymmetry. Most plausibly, supersymmetry is preserved in the curvilinear situation and off-mass-shell, thereby guaranteeing the preservation of the critical dimensionality and the absence of the tachyon. It is possible that the infinite frames act as a condensed spectrum generating algebra for the flat-case spectrum, reproducing the entire Fock space through a simple application of the infinite set of oscillators (infinite in the upper index in α/sub -nu//sup M/ as against the finite range of m in the conventional α/sub -nu//sup m/). In that case, general covariance would be realized linearly in the conventional superstring spectrum, in contradistinction to the usual particle physics Hilbert space picture.

14673 **(DOE/ER/40215—T6) Magnetic moments of quarks and leptons as three spin-1/2 composites.** Samuel, M.; Rajpoot, S.; Nandi, S. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). Nov 1986. Contract FG05-85ER40215. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87003921.

Magnetic moments of quarks and leptons built out of three spin-1/2 preons are calculated in the non-relativistic approximation. It is shown that the Harari et al. model predicts the proton-neutron magnetic moment ratio to be the same as in the static SU(6) quark model for baryons, i.e., μ/sub p//μ/sub n/ = -3/2. The Terezawa et al model gives the proton-neutron magnetic moment ratio in terms of masses and charges of the preons. The masses and charges of the preons can be chosen to give μ/sub p//μ/sub n/ = -3/2.

14674 **(EFI—86-19) Signatures of exotic fermions and other new "low-energy" phenomena in superstring E_6.** Rosner, J.L. (Chicago Univ., IL (USA)). Mar 1986. Contract AC02-82ER40073. 13p. (CONF-8509276—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004576.

From International symposium on particle and nuclear physics; Beijing, China (2 Sep 1985).

Superstring theories have drawn renewed attention to the exceptional group E_6 as a grand unified theory. We discuss the extra U(1) symmetries (beyond that in the standard SU(3) x SU(2) x U(1) model) that arise when E_6 is broken in such theories. These extra U(1)'s must lead to at least one extra neutral gauge boson, called Z', for which we give mass limits and branching ratios. Neutral current effects of this Z' and its direct production are discussed briefly. Finally, some signatures are noted of exotic fermions to which Z' can decay.

14675 (JINR—R-2-85-667, pp 127-129) **On the fundamental Lagrangian.** Pestov, A.B. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Derivation of a fundamental object associated with internal symmetry is discussed. The form of the fundamental lagrangian is supposed to be known. The fundamental object is similar to an energy-momentum tensor having external space-time symmetry as a source.

14676 **(TRI-PP—86-84) Paths from Harrogate: Toward new physics with new tools.** Vogt, E. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1986. 9p. (CONF-860802—14). NTIS (US Sales Only), PC A02. File Number DE87900323.

From International nuclear physics conference; Harrogate, UK (25 Aug 1986).

The impact of the standard model for quarks and leptons and for unified forces on the future development of nuclear physics is described. The past experience in nuclear physics with the very successful models based on the nucleon picture gives some indication how progress might be made with new experimental tools. Now nuclear physics has expanded to include all of strong interaction physics and especially the effect of nucleon substructure and quark confinement on the dynamics of the nucleus. The important new questions will be addressed with new cw electron accelerators, with relativistic heavy-ion colliders and with kaon factories.

14677 **Testing two versions of lattice gauge theory: Creutz ratios in $U(1)_3$.** Cahill, K.; Reeder, R. (Univ. of New Mexico, Albuquerque, NM). *Journal of Statistical Physics;* **43**: No. 5/6, 1043-1059(Jun 1986). (CONF-8509213—).

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

In our simplicial version of lattice gauge theory, we approximate Euclidean path integrals by tiling space-time with simplexes and by linearly interpolating the fields throughout each simplex from their values at the vertices. We compare this method with Wilson's lattice gauge theory for U(1) in three dimensions. As a standard of comparison, we compute the exact values of Creutz ratios of Wilson loops in the continuum theory. Monte Carlo compu-

tations using the simplicial method give Creutz ratios within a few percent of the exact values for reasonably sized loop at beta = 1, 2, and 10. Similar computations using Wilson's method give ratios that typically differ from the exact values by factors of 2 or more for 1 </=beta </= 3.5 and that have the wrong beta dependence. The better accuracy of the simplicial method is due to its use of the action and domain of integration of the exact theory, unaltered apart from the granularity of the simplicial lattice. We also present data on the action density and the mass gap.

14678 **Lattice gauge theory with a fast highly parallel computer.** Christ, N.H. (Columbia, Univ., New York, NY). *Journal of Statistical Physics;* **43**: No. 5/6, 1061-1072(Jun 1986). (CONF-8509213—).

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

Results for the temperature of the color deconfinement phasetransition in pure SU(3) lattice gauge theory are described. These were obtained on a specially built 16-node, 256 Megaflop computer using the Metropolis algorithm. The architecture, performance, and expansion plans for this machine are also discussed.

14679 **The β-function, scaling, and improved action for SU(3) lattice gauge theory.** Gupta, R.; Guralnik, G.; Patel, A. (Los Alamos National Lab., Los Alamos, NM). *Journal of Statistical Physics;* **43**: No. 5/6, 1101-1104(Jun 1986). (CONF-8509213—).

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

We present a detailed analysis of the nonperturbative β function along the Wilson axis for the SU(3) pure gauge theory using the Monte Carlo renormalization group method. The scaling behavior of the string tension, the deconfinement transition temperature, and the O^{3+} glueball mass obtained from published data is compared. The results show that there is no asymptotic scaling for K/ sub F/ is identical to $(6/g^2) < 6.1$. We also estimate the renormalized action generated by the $\sqrt{3}$ block transformation for use in future calculations.

14680 **Supergravity and superstrings.** Gell-Mann, M. (Physics Dept., California Institute of Technology, Pasadena, CA). pp 325-335 of Proceedings of the first Aspen winter physics conference. Block, M.M. New York, NY; The New York Academy of Sciences (1986). (CONF-850146—).

From Aspen winter physics conference; Aspen, CO, USA (14 Jan 1985).

Over the last decade, theorists have been searching hard for a unified quantum field theory of physical interactions with or without gravitation. The "standard" SU/sub 3/ x SU/sub 2/ x U/ sub 1/ theory has three independent coupling constants and numerous dimensionless parameters determining the mass ratios, the weak coupling matrix, etc. The number of sets of Higgs bosons and the representation to which they belong appear arbitrary. The theory cries out to be embedded in a bigger and more nearly unified theory. The fact that the coupling constants appear to come together somewhere between 10/sup 15/ GeV and the Planck mass of $\approx$ 2 x 10/sup 19/ GeV suggests a unified Yang-Mills theory, for example with SU/sub 5/ and three fermion families. However, such a theory, with one coupling constant, still has numerous dimensionless parameters and arbitrary Higgs boson behavior. Renormalizability is assured, but the constants, although they absorb all the infinities, are not calculable and the unified Yang-Mills theory is still obviously incomplete. In particular, the very small and rather similar ratios of Λ/sub QCD//M/sub UNIF/, various M/sub FERMION//M/sub UNIF/, and M/sub INT.BOSONS//M/sub UNIF/ must be explained. Of course, Λ/sub QCD//M/sub UNIF/ is related to exp - const/α/sub UNIF/, but then the value of the unified coupling constant near the unification mass needs explanation, which is like a modern version of the old problem of calculating 1/137. Although there is as yet no direct evidence, an attractive modification involves switching to N = 1 super-Yang-Mills theory, in which spin 1 bosons are accompanied by new spin 1/2 gluinos, photinos, etc., spin 1/2 fermions are accompanied by new spin zero squarks and sleptons, and spin zero higgsons are accompanied by new spin 1/2 shiggsons.

14681 **The Skyrme soliton: A review.** Balachandran, A.P. (Physics Dept., Syracuse Univ., Syracuse, NY 13210). pp 27-37 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

Recent developments in the solitonic model of baryons are reviewed.

14682 **Centrifugal effects in Skyrmeons.** Braaten, E. (High Energy Physics Div., Argonne National Lab., Argonne, IL 60439). pp 57-72 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The authors give a qualitative discussion of centrifugal effects in the Skyrme model and methods for treating these effects. The authors show that there may be states in the spectrum which would not appear in a semiclassical expansion about the static soliton solution. The authors consider semiclassical expansions about static solutions and about uniformly-rotating solutions, and discuss the validity and limitations of both approaches.

14683 **Dibaryons in the Skyrme model.** Lizzi, F. (Physics Dept., Syracuse Univ., Syracuse, NY 13210). pp 90-96 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The sector with baryon number two is investigated in the Skyrme model. It is shown that for two flavors there are not stable dibaryons. For three flavors there are stable dibaryon symmetric with respect of an SO(3) subgroup of the SU(3) of flavor.

14684 **Skyrmion quark mixing.** Nair, V.P.; Rodgers, V.G.J. (The Institute for Advanced Study, Princeton, NJ 08540). pp 97-102 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

Quantum fluctuations can produce small regions of chirally symmetric phase in QCD. These lead to a tunnelling transition between the Skyrmion state and a three quark state of the same quantum numbers. The baryons are then mixed states of Skyrmions and quarks. This picture agrees with data to within 8%. A proton like state at 1776 MeV and a Δ like state at 2102 MeV are predictions of the model. These are tentatively identified with resonances of simular quantum numbers at 1710 and 1920 MeV respectively.

14685 **Fermion number of the vacuum.** Banerjee, M.K. (Dept. of Physics and Astronomy, Univ. of Maryland, College Park, MD 20742). pp 142-146 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The author discusses the fermion number of the vacuum inside a chiral bag and in an open space in the presence of σ and π fields. In the case of the chiral bag, he argues that the fermion number of the vacuum is not the same as -1/2 x spectral asymmetry. The latter has been evaluated previously for a chiral bag of arbitrary shape.

14686 **Solitons and chiral bag models.** Mulders, P.J. (Center for Theoretical Physics, Lab. for Nuclear Science and Dept. of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139). pp 158-173 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The authors discuss theoretical aspects of the bag models, coupled to a pion field in a chirally invariant way. In the Lagrangian for the pion field the Skyrme term has been included. The authors also address some phenomenological aspects.

14687 **Coherent state description of non-topological solitons and momentum projection.** Birse, M.C.; Henley, E.M.; Lubeck, G.; Wilets, L. (Institute for Nuclear Theory, Dept. of Physics, FM-15, Univ. of Washington, Seattle, WA 98195). pp 189-209 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The solitons the authors are studying here are localized, static solutions to classical (or semiclassical) non-linear field equations. Being localized, they do not correspond to momentum eigenstates, even though the field theories the authors are trying to solve are translationally invariant. In order to construct states of good momentum, the authors need an explicitly quantum wave function and not just expectation values of the fields (which are all we can get from a semiclassical treatment). The techniques discussed here provide a wave function which embodies many of the features of the semiclassical (or mean field) approximation. This wave function can be projected onto states of definite momentum and hence can be used to calculate centre-of-mass corrections to soliton properties. Many of the ideas involved have been around since the early days of quantum field theory, but they have received little application. The specific model to which the authors have applied these methods is the soliton bag model. This is a model for the low energy properties of QCD in which hadrons appear as solitons in a scalar field with quarks trapped inside them.

14688 **A chiral soliton bag model with a confining scalar field.** Seki, R.; Ohta, S. (Dept. of Physics and Astronomy, California State Univ., Northridge, CA 91330). pp 235-256 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

As a possible phenomenological model of nucleons, the authors exaime a Lagrangian which combines the features of the soliton bag model of a previous study and the nonlinear sigma model. The Lagrangian is numerically solved in the semiclassical approximation without linearization for the hedgehog ansatz. Soliton solutions with winding numbers $Z = 0$ and 1 are examined as functions of the pion decay constant. The $Z = 0$ solution is similar to the cloudy bag model, but the $Z = 1$ solution is quite different from the little (chiral) bag model. The latter solution is found to have a lower energy for realistic parameter values.

14689 **Skyrmions and vector mesons: A symmetric approach.** Caldi, D.G. (Dept. of Physics, Brookhaven National Lab., Upton, NY 11973). pp 257-280 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—). Contract AC02-79ER10336;AC02-76CH00016.

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The authors propose an extension of the effective, low-energy chiral Lagrangian known as the Skyrme model, to one formulated by a non-linear sigma model generalized to include vector mesons in a symmetric way. The model is based on chiral SU(6) x SU(6) symmetry spontaneously broken to static SU(6). The rho and other vector mesons are "dormant" Goldstone bosons since they are in the same SU(6) multiplet as the pion and other pseudoscalars. Hence the manifold of the authors' generalized non-linear sigma model is the coset space (SU(6) x SU(6))/SU(6). Relativistic effects, via a spin-dependent mass term, break the static SU(6) and give the vectors a mass. The model can then be fully relativistic and covariant. The lowest-lying Skyrmion is this model is the whole baryonic 56-plet, which splits into the octet and decuplet in the presence of relativistic SU(6)-breaking. Due to the built-in SU(6) and the presence of vector mesons, the model is expected to have better phenomenological results, as well as providing a conceptually more unified picture of mesons and baryons.

14690 **Skyrmions and weak interactions.** Gipson, J.M. (Dept. of Physics, Virginia Polytechnic Institute and State Univ., Blacksburg, VA 24061). pp 289-298 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

According to the standard folklore the non-linear σ model is an effective low energy limit of QCD which describes the self-interactions of pions. As shown previously, if one adds a term which is quartic in the derivatives, the model may also support stable static solutions. The non-linear σ model has a conserved topological current. The remarkable conjecture was made that the topological charge could be identified as baryon number, and that the solitons could be quantized as fermions. Recently, there has been renewed interest in Skyrmions and the strong interaction. Such models were analyzed from the point of view of current algebra. In this paper, the author discusses Skyrmions in the context of weak interactions, and gives a summary of what has been done so far.

14691 **Fermions from bosons through effective Lagrangians in QCD.** Bhattacharya, G.; Rajeev, S. (Dept. of Physics, Syracuse Univ., Syracuse, NY 13210). pp 299-305 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

Properties of solitons in the effective Lagrangian for QCD are investigated. The Skyrme coupling constant e is calculated to be $e \simeq 6.28$ and thus the mass of the soliton is 1.1 GeV. It is shown that pseudoscalar bosons interacting with fermions cause anomalies. By matching these anomalies a fermionic Lagrangian describing the solitons is found. The coupling of the solitons to the pseudoscalar mesons is calculated. The results are in agreement with experiments if the solitons are identified with baryons.

14692 **Calculability of Newton's constant and the renormalization of scale invariant quantum gravity.** David, F.; Strominger, A. (Institute for Advanced Study, Princeton, NJ). *Physics Letters [Section] B;* **143B**: No. 1-3, 125-129(9 Aug 1984). Contract AC02-76ER02220.

The authors argue that Newton's constant is not unambiguously calculable in any non-finite pure matter theory. In finite, supersymmetric, conformally invariant theories it is calculable in terms of scalar expectation values. Implications for the renormalizability of scale invariant and conformally invariant quantum gravity are discussed. 18 references.

65 PHYSICS II

REFER ALSO TO CITATION(S) 14502

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 13909, 14676

14693 (CONF-860575—) **AIP [American Institute of Physics] conference proceedings 150: Intersections between particle and nuclear physics.** Geesaman, D.F. (ed.). (American Inst. of Physics, New York; Argonne National Lab., IL (USA)). 1986. Contract AC02-76CH00016;W-31-109-ENG-38;AC03-76SF00098;W-7405-ENG-36. 1296p. American Institute of Physics, 335 E. 45th St., New York, NY 10017. File Number TI87003436.

From 2. conference on particle and nuclear physics; Lake Louise, Canada (26 May 1986).

The subject matter for this meeting included accelerator physics, antiproton physics, electron and muon physics hadron, scattering, hadron spectroscopy, heavy ion physics, hypernuclear physics, kaon decay physics, neutrino physics, non-acceleratory physics, and spin physics. Seperate abstracts were prepared for 180 papers in these proceedings. (DWL)

14694 (INIS-SU—392, pp 54) **Nuclear resonance scattering of γ-quanta producing in the (n,γ) reaction.** Begzhanov, R.B.; Gladyshev, D.A.; Kobilov, O.Sh.; Kulabdullaev, G.A.; Uspanova, G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14695 (INIS-SU—392, pp 56) **Study on high-lying levels of nuclei by the γ-quanta resonance scattering method.** Begzhanov, R.B.; Kobilov, O.Sh.; Kulabdullaev, G.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14696 (INIS-SU—392, pp 301) **Isotope dependence of proton and alpha reaction cross sections.** Levkovskij, V.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14697 (INIS-SU—392, pp 259) **Anomalies in the internal conversion coefficients of the M1-transitions of odd spherical nuclei.** Dolgopolov, M.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14698 (INIS-SU—392, pp 302) **Decay of compound nuclei produced in the interaction of the neighbour-element stable nuclei with protons and alpha-particles.** Levkovskij, V.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14699 (INIS-SU—392, pp 330) **Study on the (tau, tau') and (tau, α) reaction mechanisms on sup(27)Al, sup(58)Ni sup(59)Co sup(112)Sn nuclei at incident helion energy Esub(tau)=60 MeV.** Burtebaev, N.T.; Dujsebaev, A.D.; Ivanov, G.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14700 **Nuclear data for basic and applied science. Volume 2.** Young, P.G.; Brown, R.E.; Auchampaugh, G.E.; Lisowski, P.W.; Stewart, L. New York, NY; Gordon and Breach (1985). 1730p. (CONF-850507—). Gordon and Breach, 50 West 23rd Street, New York, NY 10010.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

This book presents the papers given at a conference on nuclear data for basic and applied science. Topics considered at the conference included fast neutron interaction with niobium, new neutron cross sections for fusion materials studies, effect of fission dynamics on the spectra and multiplicities of prompt fission neutrons, and cold fragmentation in thermal neutron induced fission of /sup 235/U.

6511 Experimental Techniques

14701 (LBL—22406) **On-line isotope separation of projectile fragments produced in relativistic heavy-ion reactions.** Nojiri, Y.; Matsuta, K.; Minamisono, T.; Sugimoto, K.; Takeyama, K.; Hamagaki, H.; Nagamiya, S.; Omata, K.; Shida, Y.; Tanihata, I. (Lawrence Berkeley Lab., CA (USA); Osaka Univ., Toyonaka (Japan). Faculty of Science; Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study; Institute of Physical and Chemical Research, Wako, Saitama (Japan); Kyoto Univ. (Japan). Dept. of Physics; National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1986. Contract AC03-76SF00098. 10p. (CONF-860918—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003545.

From 7. international conference on hyperfine interactions; Bangalore, India (8 Sep 1986).

A new on-line separator was constructed and used successfully for the study on short-lived isotopes at the Bevalac at Lawrence Berkeley Laboratory. The isotopes were produced through projectile fragmentation processes of high energy heavy-ion reactions. Various isotopes were rigidity-separated by use of a beam line and, finally, the desired single isotope was range-analyzed to stop in a catcher. A large number of β-emitting ^{21}F nuclei were successfully collected and the nuclear lifetime was determined by detecting β rays. 11 refs., 2 figs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

14702 (DOE/ER/03244—T4) **The nonleptonic weak decay of ^{5}/sub λ/He and ^{12}/sub λ/C.** Barnes, P.D.; Szymanski, J.J. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics). 1986. Contract AC02-76ER03244. 11p. NTIS MF A01; 2; GPO Dep. File Number DE87004298.

The nonmesonic reaction: $\lambda + N \rightarrow N\ N$ is discussed as an example of a nonleptonic weak process for which calculations have been reported using various effective weak Hamiltonians. An investigation of this reaction at the AGS in the context of weak hypernuclear decay is discussed. Measurements of hypernuclear lifetimes and partial decay rates are reported for ^{5}/sub λ/He and ^{12}/sub λ/C.

14703 (INIS-SU—326, pp 388) **Microscopic investigation of the photodisintegration and radiative capture of light nuclei with accounting for interaction of collective and cluster degrees of freedom.** Vasilevskij, V.S.; Filippov, G.F.; Chopovskij, L.L.; Kruchinin, S.P. 1985. (In Russian). NTIS (US Sales Only), PC A21/MF A01. File Number DE86780472. (CONF-8504107—Summs.).

From 35. national conference on nuclear spectroscopy and structure of atomic nuclei; Leningrad, USSR (16 Apr 1985).

14704 (INIS-SU—392, pp 354) **Experimental determination of reduced vertex (/sup 4/He -> d+d) constants.** Arkatov, Yu.M.; Vatset, P.I.; Voloshchuk, V.I.; Gur'ev, V.N.; Zolenko, V.A.; Prokhorets, I.M.; Soldatov, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14705 (INIS-SU—392, pp 316) **Study on the deuteron disintegration mechanism on deuteron at the beam energy of 50 MeV.** Golovach, L.A.; Grantsev, V.I.; Zerkin, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14706 (INIS-SU—392, pp 348) **Study on the cross section asymmetry in the helium 3 two-particle photodisintegration.** Gushchin, V.A.; Zhebrovskij, Yu.V.; Karnaukhov, I.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14707 (LA—10877-T) **Measurement of the electron antineutrino mass from the beta spectrum of gaseous tritium.** Knapp, D.A. (Los Alamos National Lab., NM (USA)). Dec 1986. Contract W-7405-ENG-36. 187p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE87004782.

A measurement has been made of the mass of the electron antineutrino using the beta spectrum from a source of gaseous molecular tritium, and an upper limit of 36 eV/c^2 has been set on this mass. This measurement is the first upper limit on neutrino mass that does not rely on assumptions about the atomic configuration after the beta decay, and it has significantly smaller systematic errors associated with it than do previous measurements. 130 refs., 83 figs., 8 tabs.

14708 (TRI-PP—86-87) **Hadronic probes of few nucleon systems.** Davison, N.E. (Manitoba Univ., Winnipeg (Canada). Dept. of Physics; TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 8p. (CONF-8610196—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE87900326.

From European workshop on few body physics; Rome, Italy (7 Oct 1986).

Recent studies of few nucleon systems using hadronic probes are commented on. Emphasis is placed on nucleons and pions as probes. The sensitivities of these probes to reaction mechanisms and nuclear properties are discussed. Impressive advances have occurred in several areas, while success in others has been of an evolutionary nature. 31 refs., 6 figs.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

14709 (CONF-860270—, pp 61-65) **3-Body final states in peripheral heavy-ion collisions: nuclear clustering structure and projectile excitation revisited.** Chan, Y.; Chavez, E.; Gazes, S.B.; Kamermans, R.; Schmidt, H.R.; Siwek-Wilczynska, J.; Stokstad, R.G.; Wilczynski, J. (Lawrence Berkeley Lab., CA). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The results of two experiments involving 3-body states in peripheral heavy ion reactions are discussed. In the first experiment states in Mg-24 with significant decay widths decaying into C-12 were observed in an experiment in which a C-12 target was bombarded with Mg-24 projectiles with an energy of 15 MeV/nucleon. The experiment was performed at the LBL 88-Inch Cyclotron. In the second experiment projectile excitation was studied in Ne-20 fragmentation on an Au-197 target at 11 MeV/nucleon. Fragment excitation energies and energy spectra are presented.

14710 (CONF-860270—, pp 90-93) **Large angle correlations in 40 MeV/nucleon $^{12}C + {}^{12}C$.** Fox, D.; Cebra, D.A.; Koenig, Z.M.; Molitoris, J.J.; Ugorowski, P.; Stoecker, H.; Westfall, G.D. (Michigan State Univ., East Lansing). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Measurements of in- to out-of-plane p-p correlations, were carried out with the K500 Superconducting Cyclotron at the National Superconducting Cyclotron Laboratory using a beam of 40 MeV/nucleon ^{12}C with an average intensity of 2 particle namps. The target consisted of a 15 mg/cm^2 graphite target. No evidence for a strong peak at energies and angles corresponding to quasielastic nucleon-nucleon scattering for in- to out-of-plane ratios in p-p correlations at 40 MeV/nucleon has been found as opposed to results for 85 and 800 MeV/nucleon C + C. In addition, as was observed at 85 MeV/nucleon, the correlation between light nuclei increases with increasing mass of the observed particles. This effect cannot be described in terms of simple kinematic biases due to momentum conservation constraints. VUU calculations are consistent with this lack of a strong peak in the observed p-p correlations implying, along with the disagreement of the momentum conservation calculations, that the correlations may be due to dynamical effects. The authors thank Olaf Scholten for stimulating discussions. This work was supported by the National Science Foundation under grant No. PHY-83-12245.

14711 (CONF-860270—, pp 116-119) **Intermediate mass fragment emission from 8 to 40 MeV/u.** Charity, R.J.; Mahan, M.A.; Bowman, D.R.; Liu, Z.H.; McDonald, R.J.; Wozniak, G.J.; Moretto, L.G.; Bradley, S.; Kehoe, W.L.; Mignerey, A.C. (Lawrence Berkeley Lab., CA). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Of great interest in the intermediate energy regime (10-100 MeV/u) of heavy ion reactions is the origin of intermediate mass fragments. Theoretical models such as the liquid vapor phase transition and the cold fragmentation of a nucleus have been proposed to explain the production of these fragments. In this contribution, the authors are going to concentrate on an alternative mechanism; that of statistical decay of a compound nucleus-like system. At low bombarding energies they have shown that intermediate mass fragments arise from the binary division of a compound nucleus. Light particle evaporation and fission are two extreme examples of this more generalized decay mode. In this contribution they will show some more recent measurements which extend these studies to higher bombarding energies. Specifically they have studied the reactions $^{93}Nb + {}^{9}Be$, ^{12}C and ^{27}Al from 8.5 MeV/u. The data from 25 to 40 MeV/u were obtained with the LBL BEVALAC; from 11 to 18 MeV/u with the GSI Unilac; and the lower energy data were obtained with the LBL SuperHILAC.

14712 (DOE/ER/03496—80, pp 33-69) **Preequilibrium neutron emission in fusion of $^{165}Ho + {}^{12}C$ at 25 MeV per nucleon.** Holub, E.; Hilscher, D.; Ingold, G.; Jahnke, U.; Orf, H.; Rossner, H.; Zank, W.P.; Schroeder, W.U.; Gemmeke, H.; Keller, K. (Hahn-Meitner-Institut fuer Kernforschung Berlin, West Germany). Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

Neutrons were measured in coincidence with evaporation residues from the reaction ^{165}Ho + (300 MeV) ^{12}C. The evaporation residue velocity distribution is indicative of an average transfer of 80% of the full linear momentum in this reaction. The energy spectra of the coincident neutrons exhibit evaporative and preequilibrium components associated with integral multiplicities of M/sub EV/ = (9.5 +/- 0.5) and M/sub PE/ = (1.7 +/- 0.3), respectively. The experimental neutron energy and angular distributions are analyzed in terms of multiple-source parameterizations, assuming two or three emitters. The results are compared to those obtained from other inclusive and exclusive associated-particle data. It is ob-

served that the emission patterns of the preequilibrium neutrons are in accord with the predictions of a Fermi-jet model, for neutron angles forward of 35°, while this model fails to reproduce the data at angles in the vicinity of 90° and beyond. Various different nucleon momentum distributions have been employed in the model comparison. The insufficiency of the Fermi-jet model to reproduce the data is attributed to the neglect of two-body collisions in this one-body theory. In contrast, the shape of the angle-integrated preequilibrium-neutron energy spectrum is well reproduced with the Harp-Miller-Berne preequilibrium model, if an initial exciton number of $n_0 = 15$ is adopted. This value, as well as the preequilibrium neutron multiplicity, is at variance with systematics established previously.

14713 (INIS-SU—392, pp 314) **Nucleon emission mechanisms in the (π,πpn) reaction on C,N,O and Ag,Br nuclei at 6 MeV.** Lantsev, I.A.; Lysenko, I.V.; Malyshev, N.A.; Ostroumov, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14714 (INIS-SU—392, pp 52) **Determination of lifetimes of the 3.511, 3/2/sup -/ and 3.558 Mev, 5/2/sup +/ /sup 13/Nsup(*) nucleus resonance states using for bremsstrahlung.** Eremin, N.V.; Strizhov, V.F.; Tulinov, A.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14715 (INIS-SU—392, pp 52-53) **Lifetimes of the /sup 14/N excited states.** Georgieva, M.K.; Elenkov, D.V.; Tumbev, G.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14716 (INIS-SU—392, pp 275) **Anomalous radiative proton capture in thick targets.** Poyarkov, V.A.; Sizov, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14717 (INIS-SU—392, pp 288) **Single-particle states with the excited core in sup(13)N.** Vinogradov, A.A.; Karadzhev, K.V.; Man'ko, V.I.; Timofeev, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14718 (INIS-SU—392, pp 292) **Spectroscopic factors from analysis of the (p,d) reactions on sup(14)N and sup(19)F nuclei at Esub(p)=18.6 MeV.** Valiev, G.S.; Gulamov, I.R.; Denisov, Yu.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14719 (INIS-SU—392, pp 312) **(K/sup +/,K/sup +/p) reaction on light nuclei at the incident momenta of 0.37 and 0.6 GeV/c.** Berdnikov, Ya.A.; Likhachev, B.A.; Nikitchenko, V.I.; Ostroumov, V.I.; Shishlo, A.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14720 (INIS-SU—392, pp 317) **/sup 2/He emission from the /sup 6/Be excited state.** Bochakrev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Ogloblin, A.A.; Chulkov, L.V.; Yan'kov, G.B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14721 (INIS-SU—392, pp 318) **Dineutron emission from the /sup 6/He excited state.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Ogloblin, A.A.; Chulkov, L.V.; Yan'kov, G.B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14722 (INIS-SU—392, pp 320) **Kinematically total analysis of the (d,α) and (d,t) reactions in 13.6 MeV deuteron interaction with /sup 9/Be nuclei.** Pavlenko, Yu.N.; Vasil'ev, Yu.O.; Gass, A.S.; Kiva, V.A.; Medvedev, V.I.; Pugach, V.M.; Usik, V.A.; Shidlyk, A.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14723 (INIS-SU—392, pp 327) **Direct mechanism of the sup(19)F(sup(3)He, p)sup(21)Ne reaction at low energies.** Sarana, V.D.; Zalyubovskij, I.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14724 (INIS-SU—392, pp 332) **On the sup(9)Be(d, p)sup(10)Be reaction mechanism at Esub(d)=12.5 MeV.** Vasil'eva, O.I.; Gurevich, G.S.; Ignatenko, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14725 (INIS-SU—392, pp 333) **Reconstruction of density matrix spin-tensors of the sup(12)C 4.43 MeV (2sup(+)) nuclear state in the sup(10)B(α,dγ)sup(12)C and sup(11)B(α,tγ)sup(12)C reactions at Rsub(α)=30 MeV.** Vasil'eva, O.I.; Gurevich, G.S.; Ignatenko, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14726 (INIS-SU—392, pp 352) **Cross sections of electron elastic scattering by /sup 10/B and /sup 11/B nuclei.** Dolbilkin, B.S.; Zabrodin, A.E.; Kondrat'ev, R.L.; Lisin, V.P.; Polonskij, A.L. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14727 (INIS-SU—392, pp 370) **Two-nucleon transfer (/sup 7/Li, /sup 9/Be) reactions on /sup 6/Li, /sup 9/Be and /sup 12/C nuclei.** Glukhov, Yu.A.; Koshchij, E.I.; Mashkarov, Yu.G.; Nikol'skij, E.Yu.; Rudchik, A.T.; Sakuta, S.B.; Ustimenkov, K.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14728 (INIS-SU—392, pp 371) **Elastic and inelastic scattering of /sup 7/Li ions on /sup 6/Li, /sup 9/Be and /sup 12/C nuclei.** Glukhov, Yu.A.; Koshchij, E.I.; Lutsaj, N.S.; Mashkarov, Yu.G.; Nikol'skij, E.Yu.; Rudchik, A.T.; Sakuta, S.B.; Ustimenko, K.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14729 (INIS-SU—392, pp 372) **Deuteron, triton and /sup 4/He yield from the /sup 7/Li+/sup 14/N reaction at Esub(sup(14)N)=150MeV.** Nemets, O.F.; Rudchik, A.T.; Shvedov, A.A.; Goryunov, O.Yu.; Ponkratenko, O.A.; Shustov, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14730 (INIS-SU—392, pp 374) **Elastic and inelastic scattering of 150 MeV /sup 14/N ions by /sup 7/Li and /sup 12/C nuclei.** Goryunov, O.Yu.; Koshchij, E.I.; Lapchenko, S.Yu. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14731 (INIS-SU—392, pp 375) **Search for /sup 4/H, /sup 5/H, /sup 6/H nuclei during /sup 9/Be target irradiation by accelerated /sup 11/B ions.** Belozerov, A.V.; Borcha, K.; Dlougy, Z.; Kalinin, A.M.; Kalpakchieva, R.; Nguen Khoaj T'yau; Oganesyan, Yu.Ts.; Penionzhkevich, Yu.Eh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14732 (INIS-SU—392, pp 376) **Observation of interference of /sup 6/Li nucleus breakup and direct alpha-particle transfer in the (/sup 6/Li,d) reaction.** Artemov, K.P.; Golovkov, M.S.; Gol'dberg, V.Z.; Rudakov, V.P.; Serikov, I.N.; Timofeev, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14733 (INIS-SU—392, pp 377) **Neutron hole excitations in the (/sup 6/Li, /sup 7/Li) reaction.** Glukhov, Yu.A.; Nikol'skij, E.Yu.; Ogloblin, A.A.; Sakuta, S.B.; Stepanov, D.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14734 (INIS-SU—392, pp 378) **Proton hole excitations in the (/sup 6/Li, /sup 7/Be) reaction.** Glukhov, Yu.A.; Nikol'skij, E.Yu.; Ogloblin, A.A.; Sakuta, S.B.; Stepanov, D.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14735 (INIS-SU—392, pp 384) **Observation of /sup 6/Li nuclear level with T+/sup 3/He primary configuration.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Ogloblin, A.A.; Sakuta, S.B.; Stepanov, D.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14736 (INIS-SU—392, pp 385) **Experimental study on the final-state interaction of three neutrons.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Ogloblin, A.A.; Stepanov, D.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14737 (INIS-SU—392, pp 290-291) **Excitation energy spectra of residual nuclei in the knockout reactions of p, d, t, sup(3)He, sup(4)He from sup(12)C, sup(14)N, sup(16)O nuclei by 50 MeV protons.** Vdovin, A.I.; Golikov, I.G.; Golovin, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14738 (INIS-SU—392, pp 336) **Angular correlations of the sup(12)C(α, 2α)sup(8)Be reaction products at Esub(α)=27.2 MeV.** Kozyr', Yu.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14739 (INIS-SU—392, pp 373) **(/sup 14/N, /sup 7/Be) and (/sup 14/N, /sup 9/Be) reactions on /sup 7/Li and /sup 12/C nuclei at the /sup 14/N ion energy of 150 MeV.** Goryunov, O.Yu.; Koshchij, E.I.; Lapchenko, S.Yu. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14740 (INIS-SU—392, pp 387) **Manifestation of nuclear matter structure in fragmentation of /sup 12/C and /sup 22/Ne relativistic nuclei.** Bogdanov, V.G.; Plyushchev, V.A.; Solov'eva, Z.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14741 (INIS-SU—392, pp 324) **Excitation and decay of the sup(7)Liξ(4.63) state in the d + sup(9)Be -> αsub(1) + sup(7)Liξ(4.63) -> αsub(1) + t + α and α + sup(7)Li -> αsub(1) + sup(7)ξ(4.63) -> αsub(1) + t + α reactions.** Vasil'ev, Yu.V.; Zerkin, V.V.; Kiva, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14742 (INIS-SU—392, pp 344) **On the radiative transitions accompanying of the /sup 7/Li nucleus electrodisintegration into triton and /sup 4/He in ground state.** Volkov, Yu.M.; Kolomenskij, G.A.; Lakovichev, E.F.; Makhnovskij, E.D.; Popov, V.V.; Fominenko, V.P.; Chizhov, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14743 (INIS-SU—392, pp 349) **/sup 6/Li photodisintegration.** Likhachev, V.P.; Buki, A.Yu.; Evseev, I.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14744 (INIS-SU—392, pp 350) **Low-energy continuum in the cross section of electron elastic scattering on /sup 6/Li nucleus.** Evseev, I.G.; Buki, A.Yu.; Likhachev, V.P.; Shevchenko, N.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

6514 Nuclear Properties And Reactions, A=20-38, Experimental

14745 (DOE/ER/03496—80, pp 245-265) **Study of neutron emission in the fusion reaction ^{124}Sn + ^{28}Si at E/sub lab/ = 120 MeV.** Wile, J.L.; Schroeder, W.U.; Huizenga, J.R.; Toeke, J.; Datta, S.S.; Schmieder, L.M.; Desouza, R.T.; Butler, M.A.; Janick, M.A. (Univ. of Rochester, NY). Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

Energy spectra of neutrons evaporated in the fusion reaction ^{124}Sn + ^{28}Si at E/sub lab/ = 120 MeV were measured using a time-of-flight technique. Evaporation residue mass was also measured using the Rochester Recoil Mass Spectrometer. The average energy of neutrons in coincidence with evaporation residues was found to be higher than that predicted by statistical model calculations, in qualitative agreement with the observation of missing particle multiplicities made in previous works.

14746 (INIS-SU—392, pp 53) **Lifetime measurement of compound nucleus isolated resonant states by the shadow method and on the basis of nuclear reaction yield.** Eremin, N.V.; Melikov, Yu.V.; Tulinov, A.F.; Strizhov, V.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14747 (INIS-SU—392, pp 246) **Study on the internal bremsstrahlung accompanying the /sup 22/Na β decay.** Shumejko, A.P.; Sushkov, A.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14748 (INIS-SU—392, pp 289) **Optical potential for description of proton scattering on sup(28)Si, sup(32,34)S in the range of low and medium energies.** Romanovskij, E.A.; Spasskaya, T.I.; Borisov, A.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14749 (INIS-SU—392, pp 293) **Probabilities of gamma transitions from 7290 keV-resonance states in sup(26)Al nucleus.** Kachan, A.S.; Vodin, A.N.; Korda, L.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14750 (INIS-SU—392, pp 294) **Gamma decay of the sup(37)Cl resonance states near the isobar analog state (Esup(ast)=10.22 MeV).** Vodin, A.N.; Korda, L.P.; Kachan, A.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14751 (INIS-SU—392, pp 337) **Radiative decay of the sup(27)Al unbound states occupated in the sup(27)Al(α, $\alpha'\gamma$) reaction at Esub(α)=27.2 MeV.** Dmitrenko, V.N.; Kozyr', Yu.E.; Rudenko, B.A.; Sokolov, M.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14752 (INIS-SU—392, pp 338) **Competition between channels of particle emission from sup(27)Al states occupated in the sup(27)Al(α,$\alpha'\gamma$) reaction at Esub(α)=27.2 MeV.** Dmitrenko, V.N.; Kozyr', Yu.E.; Rudenko, B.A.; Sokolov, M.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14753 (INIS-SU—392, pp 358) **Probability of semidirect processes in the /sup 32/S nucleus giant resonance decay.** Arzibekov, U.R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14754 (INIS-SU—392, pp 386) **Observation of occupation and decay of /sup 24/Mg quasimolecular states in the /sup 12/C(/sup 14/N,d)/sup 24/Mg reaction.** Artemov, K.P.; Golovkov, M.S.; Gol'dberg, V.Z.; Rudakov, V.P.; Serikov, I.N.; Timofeev, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

6515 Nuclear Properties And Reactions, A=39-58, Experimental

14755 (DOE/ER/03496—80, pp 71-106) **Angular distribution of fission fragments produced in the reaction ^{165}Ho + ^{58}Ni at 5.9, 6.3, 7.2 and 8.5 MeV/nucleon.** Butler, M.A.; Schroeder, W.U.; Toeke, J.R.; Datta, S.S.; DeSouza, R.T.; Huizenga, J.R.; Janick, M.A.; Kosky, J.P.; Schmieder, L.M.; Wile, J.L. Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

Angular distributions of reaction-fragments from a ^{165}Ho beam impinging on a ^{58}Ni target were measured at four energies: 5.9, 6.5, 7.3 and 8.5 MeV/nucleon. The experiments were performed during December of 1984, and May of 1985 using the SuperHILAC at the Lawrence Berkeley Laboratory. Coincident reaction fragments were detected using two position-sensitive parallel plate avalanche detectors (PSAD's). The angles theta and phi of each of the reaction fragments were measured along with the difference in time of arrival of the fragments in the PSADs and the time-of-flight of the particles referred to an RF signal from the accelerator. Measurement of the scattering angles, the difference in time of arrival, and the flight paths constitutes a kinematically complete measurement with the assumption of two-body kinematics and full-momentum transfer (EYA78]. The measurement of the time of slight is used to correct for energy-loss in the target and rejection of random coincidences.

14756 (DOE/ER/03496—80, pp 222-244) **Light charged particle emission from the ^{197}Au + ^{51}V reaction at E/sub LAB/ = 447 MeV.** Schmieder, L.M.; Schroeder, W.U.; Birkelund, J.R.; Butler, M.A.; Huizenga, J.R.; Kosky, J.P.; Wilcke, W.W. Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

Alpha particles and protons were measured in coincidence with projectile-like fragments from the reaction $^{197}Au + {}^{51}V$, using two large-area light-charged-particle detectors, positioned, symmetrically with respect to the beam axis. Intensities of fragments in coincidence with light charged particles registered in either of the two detectors are indicative of strongly asymmetric emission patterns of alpha particles and protons with respect to the beam, for both fusion-fission-like and strongly damped events. Fragment Z distributions of strongly damped events depend on the light-charged-particle emission angle. This effect can be understood in terms of emission occurring preferentially after the time of scission of the intermediate nuclear complex.

14757 (INIS-SU—392, pp 55) **Study on the B(E2) of γ-transitions in /sup 57/Fe and /sup 67/Zn.** Kosyak, Yu.G.; Kaipov, D.K.; Chekushina, L.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14758 (INIS-SU—392, pp 277) **Investigation of the sup(52)Cr(p,n)sup(52m,g)Mn and sup(54)Cr(p,n)sup(54)Mn reaction cross sections in the 5-9 MeV range.** Skakun, E.A.; Batij, V.G.; Rakivnenko, Yu.N.; Rastrepin, O.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14759 (INIS-SU—392, pp 322) **Study on the total cross sections for reactions on the nuclei with 1fsub(7/2) closed neutron shell.** Dubar, L.V.; Eleukenov, D.Sh.; Nemets, O.F.; Slyusarenko, L.I.; Tokarevskij, V.V.; Yurkuts, N.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14760 (INIS-SU—392, pp 359) **Investigation on the decay properties of the /sup 40/Ca dipole giant resonance.** Zhalilov, M.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14761 (INIS-SU—392, pp 360) **Isomer ratio in the /sup 45/Sc(γ,n)sup(44m,g)Sc reaction.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Lomonosov, V.I.; Mazur, V.M.; Sokolyuk, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14762 (INIS-SU—392, pp 381) **Effects of reaction duration in /sup 40/Ar and Ge nucleus inelastic interaction.** Karamyan, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14763 (INIS-SU—392, pp 278) **Cross sections of the (p,γ) reactions on sup(54)Fe, sup(112)Sn and sup(114)Cd isotopes at the energy up to 9 MeV.** Skakun, E.A.; Batij, V.G.; Rakivenko, Yu.N.; Rastrepin, O.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14764 (INIS-SU—392, pp 323) **48.5 MeV deuteron disintegration in interaction with /sup 58/Ni and /sup 64/Ni nuclei.** Grantsev, V.I.; Dmitrenko, V.N.; Dryapachenko, I.P.; Evlanov, M.V.; Kozyr', Yu.E.; Nemets, O.F.; Rudenko, B.A.; Sokolov, M.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14765 (INIS-SU—392, pp 361) **On the α/p yield relationship from compound states of high-excited Ni nucleus in the Ni(e,e'c) reaction.** Vojtsekhovskij, B.B.; Nikolenko, D.M.; Popov, S.G.; Popova, N.I.; Tsentalovich, E.P.; Pugach, V.M.; Medvedev, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14766 (INIS-SU—392, pp 296) **Cross section of the /sup 49/Ti(p,γ)/sup 50/V and /sup 49/Ti(p,n)/sup 49/V reactions.** Fedorets, I.D.; Zalyubovskij, I.I.; Nemashkalo, B.A.; Storizhko, V.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14767 (INIS-SU—392, pp 297) **Determination of the radiative strength function for /sup 53/Mn nucleus.** Shebeko, K.V.; Nemashkalo, B.A.; Storizhko, V.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

6516 Nuclear Properties And Reactions, A=59-89, Experimental

14768 (CONF-860270—, pp 30-35) **Reaching the p-d and n-drip lines by intermediate-energy heavy ion fragmentation.** Mueller, A.C. (GANIL, Caen-Cedex, France). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The fragmentation of a heavy projectile of relativistic energy exhibits two interesting features: since there is only very small momentum transfer between the projectile and the target, the produced fragments are moving close to the projectile velocity and their angular distribution is peaked around 0°. These properties allow for in-flight magnetic separation. It has been shown that the mechanism of projectile fragmentation remains predominant in the intermediate-energy (20-100 MeV/n) regime which is covered by the accelerator facility GANIL at Caen. Comparatively high heavy-ion beam intensities are available at GANIL with excellent focal qualities which allowed for some recent advance in producing isotopes at both drip-lines for light elements. The search for light nuclei at the drip-lines has been done so far by fragmentation of Ar and Ca beam on the neutron-rich and neutron deficient side, respectively. As an example of experimental results, the fragments obtained by the interaction of a 77 MeV/u ^{40}Ca beam with a 92 mg/cm^2 Ni target are shown.

14769 (INIS-SU—392, pp 57) **M1-transitions between the 8/sup +/ states of a /sup 68/Ge nucleus.** Kiptilyj, V.G.; Lemberg, I.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14770 (INIS-SU—392, pp 58) **Probability of E2-transitions between the high spin states of /sup 74/Se.** Zhovliev, U.J.; Kudoyarov, M.F.; Lemberg, I.Kh.; Pasternak, A.A.; Rassadin, L.A.; Adam, I.; Gonusek, M.; Shpalek, A.; Tlusty, P.; Vyborzhil, I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14771 (INIS-SU—392, pp 59-60) **Study on the angular correlation of γ-quanta emitted in the /sup 74/Ge(α,2n)/sup 76/Se reaction.** Kiptilyj, V.G.; Lemberg, I.Kh.; Rassadin, L.A.; Chugunov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14772 (INIS-SU—392, pp 61) **Plunger measurement of the /sup 76/Br excited state lifetimes.** Kudoyarov, M.F.; Lemberg, I.Kh.; Pasternak, A.A.; Rassadin, L.A.; Dering, I.; Vinter, D.; Funke, L. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14773 (INIS-SU—392, pp 63-64) **Scheme of the /sup 78/Se excited state decay from the /sup 78/Se(n,n'γ)/sup 78/Se reaction.** Dostemesova, G.A.; Kaipov, D.K.; Kosyak, Yu.G.; Lysikov, Yu.A.; Chekushina, L.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14774 (INIS-SU—392, pp 65) **Lifetimes of the /sup 79/Kr nucleus excited states.** Zhovliev, U.J.; Kudoyarov, M.F.; Lemberg, I.Kh.; Pasternak, A.A.; Rassadin, L.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14775 (INIS-SU—392, pp 66-67) **Scheme of the /sup 80/Se excited state decay from the /sup 80/Se(n,n'γ)/sup 80/Se reaction.** Chekushina, L.V.; Kosyak, Yu.G.; Kaipov, D.K.; Lysikov, Yu.A.; Dostemesova, G.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14776 (INIS-SU—392, pp 69) **Angular distributions of γ rays emitted in the /sup 82/Se(α,2nγ)/sup 84/Kr reaction at Esub(α)=12.5 MeV.** Zobov, A.E.; Lemberg, I.Kh.; Mishin, A.S.; Chugunov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14777 (INIS-SU—392, pp 70-71) **Angular distributions of γ rays and quantum characteristics of the /sup 84/Kr nucleus excited states.** Zobov, A.E.; Lemberg, I.Kh.; Mishin, A.S.; Chugunov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14778 (INIS-SU—392, pp 71) **Measurement of the /sup 84/Kr nucleus energy level lifetimes by the ODS method in γ-γ coincidences.** Zobov, A.E.; Izotov, A.L.; Lemberg, I.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14779 (INIS-SU—392, pp 72) **Decay scheme of a /sup 85/Kr nucleus.** Zobov, A.E.; Izotov, A.L.; Lemberg, I.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14780 (INIS-SU—392, pp 73) **/sup 85/Kr gamma-ray angular distributions.** Zobov, A.E.; Lemberg, I.Kh.; Mishin, A.S.; Chugunov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14781 (INIS-SU—392, pp 74) **Lifetimes of /sup 85/Kr nucleus energy levels.** Zobov, A.E.; Lemberg, I.Kh.; Mishin, A.S.; Chugunov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

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14783 (INIS-SU—392, pp 500) **Elastic scattering of near-barrier protons by sup(63,65)Cu and sup(64,66,68)Zn nuclei.** Romanovskij, E.A.; Saidov, B.M.; Borisov, A.M.; Nguen Mak Kha; Ermakov, S.V.; Khussejn Khamad Abbd; Timofeyuk, N.K.; Spasskaya, T.I.; Galakhmatova, B.S.; Goryaga, N.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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14784 (INIS-SU—392, pp 313) **Study on the (π,πd) and (π,πHe) reactions on Ag and Br nuclei at 60 MeV.** Lantsev, I.A.; Lysenko, I.V.; Pikhtov, S.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14785 (INIS-SU—392, pp 315) **Manifestation of Ag and Br nucleus cluster structure in the reactions of 60-170 MeV π/sup +/ meson absorption with escape of two and three fast protons.** Lantsev, I.A.; Lysenko, I.V.; Pavlov, A.V.; Ostroumov, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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14786 (INIS-SU—392, pp 362) **Deep spallation reaction induced by electrons and γ-bremsstrahlung in cobalt.** Batij, V.G.; Vladimirov, Yu.V.; Rakivnenko, Yu.N.; Ranyuk, Yu.N.; Rastrepin, O.A.; Skakun, E.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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14787 (INIS-SU—392, pp 367) **Difference in parameters of the charge density distribution for sup(76,78,80,82)Se isotopes from electron elastic scattering.** Khomich, A.A.; Shevchenko, N.G.; Buki, A.Yu.; Polishchuk, V.N.; Nazarova, T.S.; Mazan'ko, B.V.; Kuprikov, V.I.; Ranyuk, Yu.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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14788 (INIS-SU—392, pp 68) **Angular γγ correlations in a /sup 82/Kr nucleus.** Akbarov, A.; Ibragimov, B.; Kuldzhanov, I.K.; Muminov, A.I.; Razhabbaev, R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14789 (INIS-SU—392, pp 329) **Isotopic dependence of emission of protons produced in the approximately 24 MeV α-particle interaction with Ni isotopes.** Smirnov, A.V.; Antropov, A.E.; Zarubin, P.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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14790 (INIS-SU—392, pp 364-365) **Electro- and photodisintegration of Y, Zr, Nb, Mo, sup(113)In, sup(115)In nuclei at the electron energy of 275 MeV.** Batij, V.G.; Vladimirov, Yu.V.; Rakivnenko, Yu.N.; Ranyuk, Yu.N.; Rastrepin, O.A.; Skakun, E.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14791 (INIS-SU—392, pp 366) **Mean energies of photon-eutron spectra for sup(67,70)Zn, sup(74,77)Se, sup(84,86,87,88)Sr, sup(181)Ta and sup(183)W isotopes.** Goryachev, A.M.; Zalesnyj, G.N.; Seliverstov, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14792 (INIS-SU—392, pp 298) **Quantum characteristics of proton resonances in the /sup 60/Ni(p,γ)/sup 61/Cu reaction.** Izosimov, I.N.; Kraft, O.E.; Naumov, Yu.V.; Parzhitskij, S.S.; Sigalov, V.M.; Sizov, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14793 (INIS-SU—392, pp 340) **Angular correlations of charged products from the /sup 64/Ni(α,α'c) reaction at the α-particle energy of 96 MeV.** Medvedev, V.I.; Vasil'ev, Yu.O.; Kiva, V.A.; Pavlenko, Yu.N.; Pugach, V.M.; Berdnichenko, S.V.; Kibkalo, T.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

6517 Nuclear Properties And Reactions, A=90-149, Experimental

14794 **(CEA-CONF—8451) Light nuclei produced in the $^{20}Ne + {}^{93}Nb$ reaction at 30 MeV/u.** Morjean, M.; Billerey, R.; Chambon, B. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). May 1986. 2p. (CONF-860506—7-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE87750709.

From International conference on heavy ion nuclear collisions in the Fermi energy domain; Caen, France (12 May 1986).

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14795 (CONF-860270—, pp 10-12) **Neutron emission prior to fission.** Gavron, A.; Gayer, A.; Boissevain, J.; Britt, H.C.; Nix, J.R.; Sierk, A.J.; Grange, P.; Hassani, S.; Weidenmueller, H.A.; Beene, J.R. (Los Alamos National Lab., NM). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

In recent years, many groups have measured neutrons and light charged particles in coincidence with fission fragments in heavy ion reactions. In most cases, particles emitted with an energy spectrum and angular distribution characteristic of that of compound nucleus evaporation have been measured in excess of statistical model predictions. They have chosen to investigate this effect in detail by studying neutron emission in the ^{158}Er composite system. The advantage of this system is that it can be produced by a variety of projectile target combinations. They have chosen four combinations which form ^{158}Er with similar critical angular momenta but varying excitation energy. The rationale is to form the same system with different neutron emission times; if the enhanced neutrons are being emitted during the fission process, the different emission time scales might possibly be used to time the fission process. In addition, they impose an additional constraint - that they have a significant fission barrier for most of the partial waves involved in the fission process. The reactions they have selected are $^{16}O + {}^{142}Nd$ (207 MeV beam energy), $^{24}Mg + {}^{134}Ba$ (180 MeV), $^{32}S + {}^{126}Te$ (180 MeV), $^{50}Ti + {}^{108}Pd$ (216 MeV).

14796 (CONF-860270—, pp 22-25) **Study of unusual fission-mass distributions, a < 200, using ~ 200 MeV proton and ^{3}He fission.** Becchetti, F.D.; Lister, P.M.; Jaenecke, J.; Nadasen, A.; Brown, J.; Karwowski, H.; Kwiatowski, K.; Hicks, K.H. (Univ. of Michigan, Ann Arbor). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Recent studies of proton-induced fission of targets 80 < A < 200 have indicated unusual fission-mass distributions near A = 140. They have continued measurements with protons E = 190 MeV, and added ^{3}He, E = 270 MeV, at the Indiana University Cyclotron. The target nuclei included Nb, Ag, La, Ce, Pr, Nd, Dy, and heavier targets. Targets were made from ultrapure materials to minimize heavy contaminants. ΔE and E combined with TOF information (relative to the cyclotron beam, Δt ≦ 0.8 nsec) was used to separate and identify coincident fission fragments, determine their angular correlations and deduce approximate Z, M, and determine the kinetic energy release (TKE). Selected ΔE - E spectra, ΔZ/Z distributions, angular distributions and cross sections are presented.

14797 (CONF-860270—, pp 75-78) **Projectile residues from the 40-MeV/u La + La reaction.** Bradley, S.; Mignerey, A.C.; Weston-Dawkes, A.; Wozniak, G.J.; Moretto, L.G.; McMahan, M.A.; McDonald, R.J.; Charity, R.J.; Liu, Z.H.; Pacheco, A.J. (Univ. of Maryland, College Park). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Inclusive measurements of products from the interaction of 40 = MeV/u La on La (3.87 mg/cm²) were performed at the LBL BEVALAC. Two large acceptance angle ΔE (gas), E (Si) telescopes were placed on either side of the beam subtending solid

angles from 24° to 33° and -4° to -9° (opposite side of beam, hereafter designated as 4° to 9°). These telescopes were position sensitive in two dimensions. The in-plane angular position was determined using voltage division of a resistive grid evaporated on the face of the 2 mm thick Si detectors. Out-of plane angles were determined by the drift time of ions in the gas section. Fragment charge could be identified from Z = 6 to Z = 30. Charges for fragment with Z > 30 to the identifiable elastic Z = 57 were obtained mathematically using energy loss calculations and the shapes of the individually resolved charge curves. The inclusive relative velocity spectra for a range of fragments detected in the laboratory from 4°-6° are shown.

14798 (CONF-860270—, pp 113-115) **Fragment emission in proton-xenon interactions at near-threshold energies.** Porile, N.T.; Bujak, A.; Carmony, D.D.; Chung, Y.H.; Gutay, L.J.; Hirsch, A.S.; Mahi, M.; Paderewski, G.L.; Sangster, T.C.; Scharenberg, R.P. . (Purdue Univ., West Lafayette, IN). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

A gas jet target was installed in the main ring of the Brookhaven Alternating Gradient Synchrotron (AGS) and proton-xenon interactions were studied over the 1.5-25 GeV energy range. Fragments with Z = 2-14 were detected with TOF-ΔE-E spectrometers installed at 45° and 135° to the beam. Absolute normalization was provided by recoil protons from p-p elastic scattering with the hydrogen component of the gas jet. These protons, which ranged from 5 to 20 MeV depending on the beam energy, were detected by two solid state ΔE-E telescopes located at 84° to the beam. The results of a preliminary analysis of the data are shown.

14799 (INIS-SU—392, pp 75) **Cross sections of the γ-transition excitation in the /sup 90/Zr(n,n'γ) reaction.** Blinov, M.V.; Saidgareev, V.M.; Filatenkov, A.A.; Chuvaev, S.V.; Shiryaev, V.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14800 (INIS-SU—392, pp 76) **Measurement of correlations of γ-ray directions in /sup 94/Mo nucleus.** Belyavenko, V.S.; Borozenets, G.P.; Vishnevskij, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14801 (INIS-SU—392, pp 77) **Sup(94m)Tc decay.** Ageev, V.A.; Belyavenko, V.S.; Vishnevskij, I.N.; Zheltonozhskij, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14802 (INIS-SU—392, pp 78) **Study on the /sup 96/Nb decay.** Belyavenko, V.S.; Borozenets, G.P.; Vishnevskij, I.N.; Zheltonozhskij, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14803 (INIS-SU—392, pp 79) **K-capture probabilities in the sup(99)Rh, sup(106)Ag and sup(108)Ag nucleus decays.** Begzhanov, R.B.; Azimov, K.Sh.; Magrupov, R.D. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14804 (INIS-SU—392, pp 82-83) **Lifetimes of /sup 104/Rh and /sup 116/In excited states.** Kondurov, I.A.; Loginov, Yu.E.; Martynov, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14805 (INIS-SU—392, pp 83-84) **Excitation of sup(108mg)In and sup(120mg)Sb isomers.** Baskova, K.A.; Vovk, A.B.; Krivonogov, Yu.V.; Makuni, B.M.; Chugaj, T.V.; Shavtvalov, L.Ya. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14806 (INIS-SU—392, pp 84-85) **B(E2)ratios for /sup 108/Cd in the interacting boson model.** Sychikov, G.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14807 (INIS-SU—392, pp 85) **/sup 109/In excited state lifetimes.** Kudoyarov, M.F.; Pasternak, A.A.; Rassadin, L.A.; Trishin, V.V.; Lobach, Yu.N.; Tkachuk, I.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14808 (INIS-SU—392, pp 86) **/sup 111/Cd energy levels excited in the (nsub(res), γ) reaction.** Baskova, K.A.; Borisov, G.I.; Vovk, A.B.; Gerus, T.M.; Govor, L.I.; Demidov, A.M.; Mikhajlov, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14809 (INIS-SU—392, pp 88) **Study on the /sup 113/Cd 5603 keV energy level using the (γγ) reaction.** Begzhanov, R.B.; Kobilov, O.Sh.; Kulabdullaev, G.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14810 (INIS-SU—392, pp 89) **Determination of energy-level transitions in a /sup 113/Sb nucleus and the structure of low-lying excited states in the antimony odd isotopes 113-121.** Burminskij, V.P.; Dombrovskaya, G.S.; Kovrigin, O.D.; Mitroshin, V.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14811 (INIS-SU—392, pp 90) **Gamma rays of /sup 113/Sn from the /sup 115/In(p,3nγ) reaction.** Vishnevskij, I.N.; Dej, Yu.A.; Lobach, Yu.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14812 (INIS-SU—392, pp 94) **Gamma spectrometric study on the radiative neutron capture cross section of sup(115)In and sup(197)Au at Esub(n)=2.7 MeV.** Demekhin, V.L.; Majdanyuk, V.K.; Orimenko, G.I.; Tarakanov, V.K. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14813 (INIS-SU—392, pp 95) **Measurement of XK-radiation and γ-quanta intensities at 23,875 keV in the sup(119m)Sn decay.** Egorov, A.G.; Nedovesov, V.G.; Sidorenko, S.A.; Shchukin, G.E.; Dryyak, P.; Kovark, P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14814 (INIS-SU—392, pp 96-97) **Study on the γ-transition multiple mixing from the sup(122)Te(n,n'γ) reaction.** Berendakov, S.A.; Galyamin, S.N.; Govor, L.I.; Demidov, A.M.; Mikhajlov, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14815 (INIS-SU—392, pp 103-104) **Hard γ-quanta from the sup(133)(n,γ) reaction and the levels sup(134)Cs.** Kondurov, I.A.; Sushkov, P.A.; Fedorova, Eh.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14816 (INIS-SU—392, pp 105) **On the deformation of nuclei in the 50 < Z,N < 82 range (according to charge radii of neutron-deficient europium nuclei).** Alkhazov, G.D.; Barzhakh, A.E.; Denisov, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14817 (INIS-SU—392, pp 107) **Energy of the sup(145)Tb -> sup(145)Gd decay.** Veselov, G.V.; Mezilev, K.A.; Novikov, Yu.N.; Popov, A.V.; Sergienko, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14818 (INIS-SU—392, pp 233) **Strength function structure of the β-decay of delayed neutron emitters.** Alkhazov, G.D.; Bykov, A.A.; Vitman, V.D. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14819 (INIS-SU—392, pp 243) **Measurement of the total internal conversion coefficients of the M4-transitions in sup(117)In and sup(117)Sn.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Stepanenko, V.A.; Ukhin, M.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14820 (INIS-SU—392, pp 280) **Absolute and relative (p,n) reaction cross sections with isomer production in silver isotopes.** Batij, V.G.; Skakun, E.A.; Rakivnenko, Yu.N.; Rastrepin, O.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14821 (INIS-SU—392, pp 304) **Microscopic analysis of the sup(90)Zr(p,n)sup(90)Nb reaction at Esub(p)=22.2 MeV.** Borzov, I.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14822 (INIS-SU—392, pp 306) **Determination of the radiative strength functions of Sm and Gd isotopes on the base of the (n,γ) reaction.** Bechvari, F.; Montero-Kabrera, M.Eh.; Telezhnikov, S.A.; Khoang Tyong Khiep. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14823 (INIS-SU—392, pp 331) **Study on the nuclear structure of tin even isotopes by the α-particle inelastic scattering method.** Kuterbekov, K.A.; Ajsina, S.Ya.; Yushkov, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14824 (INIS-SU—392, pp 379) **Excitation of giant resonances in heavy ion reactions.** Kamanin, V.V.; Kugler, A.; Mikhajlova, T.I.; Penionzhkevich, Yu.Eh.; Sobolev, Yu.G.; Eremin, N.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14825 (INIS-SU—392, pp 98) **Sup(123)I decay.** Ageev, V.A.; Belyavenko, V.S.; Zheltonozhskij, V.A.; Klyuchnikov, A.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14826 (INIS-SU—392, pp 101-102) **Hard γ quanta from the sup(129)J(n,γ) reaction.** Egorov, A.I.; Kondurov, I.A.; Loginov, Yu.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14827 (INIS-SU—392, pp 244) **Sup(115)In isomer excitation by positions with the boundary energy of 1.04 MeV.** Borozenets, G.P.; Vishnevskij, I.N.; Zheltonozhskij, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14828 (INIS-SU—392, pp 368) **Isomer ratios of the Sn(γ,pxn)sup(110m,g)In reaction yields.** Arakelyan, A.A.; Balabekyan, A.R.; Danagulyan, A.S.; Khudaverdyan, A.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14829 (INIS-SU—392, pp 91) **Scheme of the /sup 113/Sn energy levels excited in the /sup 113/In(p,nγ) reaction.** Vishnevskij, I.N.; Dej, Yu.A.; Lobach, Yu.N.; Mel'nikov, O.B.; Sidorenko, V.A.; Tkachuk, I.P.; Trishin, V.V.; Chaplitskaya, T.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14830 (INIS-SU—392, pp 548) **Determination of the /sup 109/Cd and /sup 113/Sn half-lives.** Konstantinov, A.A.; Sazonova, T.E.; Sehpman, S.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14831 **(LBL—21998) Complex fragment emission at low and high excitation energy.** Moretto, L.G. (Lawrence Berkeley Lab., CA (USA)). Aug 1986. Contract AC03-76SF00098. 41p. (CONF-8609190—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003542.

From 18. summer school on nuclear structure studies by means of nuclear reactions; Mikolajki, Poland (1 Sep 1986).

Complex fragment emission has been certified as a compound nucleus process at low energies. An extension of the measurements to heavy ion reactions up to 50 MeV/u shows that most complex fragments are emitted by highly excited compound nuclei formed in incomplete fusion reactions. 12 refs., 26 figs.

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14832 (CONF-860270—, pp 36-39) **Excitation energy division in the 9MeV/nucleon ^{58}Fe + ^{165}Ho reaction.** Benton, D.R.; Breuer, H.; Khazaie, F.; Kwiatkowski, K.; Viola, V.E.; Bradley, S.; Mignerey, A.C.; Weston-Dawkes, A.P.; McDonald, R.J. (Univ. of Maryland, College Park). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The ^{58}Fe + ^{165}Ho reaction has been studied with a 505 MeV ^{58}Fe beam at the LBL Super-HILAC. The projectile like fragments (PLF) were detected at a laboratory angle of 26° by a detector system consisting of a micro-channel plate time-of-flight spectrometer rand a two-dimensional position-sensitive gas-ionization chamber backed by a silicon surface barrier detector. The mass, velocity, kinetic energy, and charge of the PLF have been determined for each event with a full-width at half maximum (FWHM) resolution for elastically scattered projectiles of 0.9 mass units, 0.5 charge units, 3 MeV in kinetic energy, and less than 0.1 ° in angle. A position-sensitive parallel-plate avalanche counter was used to detect the heavier reaction fragments in coincidence with the PLF's. Several overlapping angle settings of the avalanche counter covered the full range of two-body reactions of interest with a resolution of 0.4°. The PACE-2 evaporation code was used to calculate neutral and charged particle evaporation as a function of excitation energy from all nuclides corresponding to PLF's. The results of the PACE-2 calculation were used along with the measured data to deduce a PLF excitation energy and nuclear charge prior to evaporation, given the constraint that the results of the calculation and the observed data be consistent. The total amount of excitation energy in both fragments was calculated for each event by subtracting the energy required to form the ground states of the fragments from the kinetic energy loss derived from knowledge of the kinematics. The ratio of the excitation energy in the PLF to the total excitation energy in the system was calculated for each event. This ratio and other parameters were calculated event-by-event, gated by appropriate conditions, and then accumulated into histograms.

14833 (CONF-860270—, pp 66-69) **Signatures of fast alpha-particle emission in damped heavy-ion reactions.** Toke, J.; Birkelund, J.R.; Butler, M.A.; Huizenga, J.R.; Kosky, J.P.; Schmieder, L.M.; Schroeder, W.U.; Wilcke, W.W. (Univ. of Rochester, NY). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

In order to study the mechanisms of light particle emission in heavy-ion collisions, the authors have measured velocity vector distributions and angular correlations of alpha particles emitted in the heavy-ion reaction ^{58}Ni + ^{165}Ho at 8.2 MeV per nucleon. The experiment was carried out at the Lawrence Berkeley Laboratory SuperHILAC. Heavy reaction products were identified in a ΔE-E telescope located slightly forward of the grazing angle at 9.9°, thus allowing us to select primary (binary) processes ranging from weakly damped collisions to fusion-fission reactions. Alpha particles were measured in coincidence with defining heavy fragments in two arrays of three plastic scintillators (NE102) viewed by photomultipliers. Proportional gas ΔE counters located in front of the scintillator arrays provided reliable discrimination between alpha particles and other light products, mostly protons. In addition, employing the charge division method, accurate position (angle) information was obtained from these ΔE detectors.

14834 (CONF-860270—, pp 70-74) **Deflection of non-equilibrium light particles by the nuclear mean field.** Tsang, M.B.; Ronningen, R.M.; Bertsch, G.; Chen, Z.; Chitwood, C.B.; Fields, D.J.; Gelbke, C.K.; Lynch, W.G.; Nayak, T.; Pochodzalla, J. (Michigan State Univ., East Lansing). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The authors have addressed issues involving the nuclear mean field by determining the sign of the average emission angle of non-equilibrium light particles from the circular polarization of associated γ-rays emitted by the residual nucleus for ^{14}N induced reactions on ^{154}Sm at E/A = 20 and E/A = 35 MeV. For these mass-asymmetric systems, the light particle spectra are dominated by non-equilibrium processes, with the emission of light particles strongly enhanced in the entrance channel scattering plane. The experiment was performed at the National Superconducting Cyclotron Laboratory at Michigan State University.

14835 (DOE/ER/03496—80, pp 197-221) **Light-charged-particle emission patterns observed in the inverse-kinematics reaction ^{58}Ni + ^{165}Ho at 8.2 MeV/Nucleon.** Toeke, J.; Butler, M.A.; Huizenga, J.R.; Kosky, J.P.; Schmieder, L.M.; Schroeder, W.U.; Wilcke, W.W. (Univ. of Rochester, NY). Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

Alpha particles and protons were measured in coincidence with heavy reaction products from the ^{58}Ni + ^{165}Ho reaction at 1355 MeV. Double-differential Galilei-invariant cross sections d^{3}σ/(v/sub perpendicular/.dv/sub perpendicular/.dv/sub parallel/) were obtained with large range of angles and velocities, for different components in the primary reaction yield. The observed emission patterns cannot be satisfactorily understood within the picture of statistical emission from the composite system and from the fully accelerated projectile- and target-like ejectiles. The most striking discrepancy with expectations based on statistical evaporation models is the lack of any significant yield from the light, target-like ejectile at large positive angles. A left-right in-plane asymmetry in the light-charged-particle yield is clearly seen, in agreement with earlier experiments. This asymmetry is most pronounced for damped primary processes. The observed emission patterns point to the importance of dynamical emission processes taken place during or immediately after the dinuclear stage of the collision.

14836 (INIS-SU—392, pp 110) **Magnetic properties of the rotational bands of the odd nuclei in the 150 < A < 190.** Alikov, B.A.; Badalov, Kh.N.; Kuznichenko, A.V.; Lebedev, V.N.; Mumnov, T.M.; Sharonov, I.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14837 (INIS-SU—392, pp 115) **Precise determination of γ-transition multipolariies in holmium and thulium nuclei.** Gromov, K.Ya.; Islamov, T.A.; Baratova, M.A.; Kononenko, G.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14838 (INIS-SU—392, pp 117-118) **γ-spectrum of sup(156)Eu from the (n,γ) reaction and transition multipolarities.** Kramer, N.D.; Prokof'ev, P.T.; Shrekebakh, K.; Spits, A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14839 (INIS-SU—392, pp 119-120) **Sup(160)Tb gamma spectrum.** Adam, I.; Vinogradov, V.M.; Grigor'ev, E.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14840 (INIS-SU—392, pp 121-122) **E0-transitions in sup(160)Dy.** Grigor'ev, E.P.; Dadamukhamedov, T.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14841 (INIS-SU—392, pp 123) **Study on the γ-cascades in the sup(163)Dy compound nucleus decay by the method of coinciding pulse amplitude summation.** Boneva, S.T.; Vasil'ev, Eh.V.; Popov, Yu.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14842 (INIS-SU—392, pp 133) **Energies and relative intensities of the KLL groups in Auger spectrum of W.** Bulgakov, L.P.; Gavrilyuk, V.I.; Kirishchuk, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14843 (INIS-SU—392, pp 232) **On the impossibility of refinement of neutrino mass from the sup(158)Tb decay.** Gorozhankin, V.M.; Rukhadze, N.I.; Brzhanson, Sh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14844 (INIS-SU—392, pp 242) **Measurement of the total internal conversion coefficients in sup(178,180)Hf nuclei.** Belyavenko, V.S.; Vishnevskij, I.N.; Zheltonozhskij, V.A.; Muzalev, P.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14845 (INIS-SU—392, pp 307) **Spectra and angular distributions of neutrons from the (p,n) reaction on sup(165)Ho, sup(181)Ta, sup(197)Au, sup(209)Bi nuclei at Esub(p)=11.2 MeV.** Biryukov, N.S.; Zhuravlev, B.V.; Rudenko, A.P.; Trykova, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14846 (INIS-SU—392, pp 369) **Activation level of /sup 181/Ta isomer (Tsub(1/2)=18μs) from the photoexcitation reaction by bremsstrahlung with boundary energy of 3-4 MeV.** Dubenskij, A.P.; Dubenskij, V.P.; Bojkova, E.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14847 (INIS-SU—392, pp 380) **Analysis of gamma spectra from the /sup 22/Ne+/sup 150/Nd reaction in the frameworks of the statistical model.** Ershov, S.N.; Ivanova, S.P.; Kamanin, V.V.; Kugler, A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14848 (INIS-SU—392, pp 113) **Study on the decay of sup(154)Eu nuclei oriented in iron.** Kratsikova, T.I.; Davaa, S.; Finger, M.; Shmechek, P.; Budzymski, M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14849 (INIS-SU—392, pp 538) **Nuclear orientation of sup(169)Yb in gadolinium.** Davaa, S.; Kratsikova, T.I.; Finger, M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14850 (INIS-SU—392, pp 543) **Measurements of hyperfine magnetic fields on nuclei sup(181)Ta in LuFe/sub 2/.** Komissarova, B.A.; Kochetov, O.I.; Krupa, Eh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14851 (INIS-SU—392, pp 547) **Gradient of electric field acting on /sup 181/Ta in HfO(NO/sub 3/)/sub 2/ x 2H/sub 2/O.** Misheva, M.A.; Tumbev, G.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14852 **Precision measurements of gamma-ray energies from 13.3a /sup 152/Eu decay.** Warburton, E.K.; Alburger, D.E. (Brookhaven National Lab., Upton, NY, USA). *Nuclear Instruments and Methods in Physics Research;* **253**: No. 1, 38-42(15 Dec 1986). Contract AC02-76CH00016.

The energies of 29 γ from the decay of /sup 152/Eu have been determined in order to provide calibration energies for Ge γ-ray spectrometers. Particular emphasis is placed on those γ transitions resulting from the decay of the /sup 152/Sm 1530 keV level. A least-square adjustment to these /sup 152/Sm γ transitions results in a set of recommended calibration lines.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

14853 (CONF-860270—, pp 44-47) **Transition from quasi-elastic to deep-inelastic reactions.** Rehm, K.E. (Argonne National Lab., IL). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Heavy ion induced transfer reactions are usually considered to fall into two categories. Quasi-elastic processes, on one hand, are characterized by small energy transfers, with one-nucleon transfer reactions being a typical example. These processes are dominant for grazing collisions and are generally described within simple one-step DWBA calculations. Deep inelastic reactions, on the other hand, occur for more central collisions where the interaction time is longer and subsequently more energy and particles can be exchanged. Quasi-elastic collisions dominate transfer reactions induced by light heavy ions (e.g. ^{16}O) at energies not too high above the barrier, while deep inelastic collisions are observed mainly in reactions induced by heavier projectiles (Kr, Xe). In this contribution, the authors discuss the transition between these two processes for the system $^{48}Ti + ^{208}Pb$. ^{48}Ti is located between light (^{16}O) and heavy (Kr) projectiles and should be well suited for a study of the interrelation between quasi- and deep-inelastic reactions.

14854 (CONF-860270—, pp 79-84) **Source radii and emission temperatures for ^{14}N induced reactions on ^{197}Au at E/A=35 MeV.** Pochodzalla, J. (Michigan State Univ., East Lansing). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The emission of complex particles prior to the attainment of full statistical equilibrium of the composite system is clearly established for intermediate energy nucleus-nucleus collisions. In the absence of a complete dynamical treatment, recourse is often taken to models based on the assumption of statistical particle emission from subsets of nucleons characterized by their average velocity, space-time extent, and excitation energy or temperature. Information about the space-time extent of the emitting system can be obtained from the two-particle correlation function. Emission temperatures can be extracted from the relative population of states. The experiment was performed at the National Superconducting Cyclotron Laboratory of Michigan State University. A gold target of 19 mg/cm^2 areal density was irradiated by a beam of ^{14}N of E/A=35 MeV incident energy. Light particles ($Z \leqq 2$) were detected by a close-packed (ΔTheta $\cong$ 6.1°) hexagonal array of 13 ΔE-E telescopes. Measurements were performed with the center of the hodoscope positioned at laboratory angles of 35° and 50°. The data is presented in terms of the correlation function.

14855 (CONF-860270—, pp 85-89) **High energy gamma ray emission in heavy ion collisions.** Stevenson, J.; Beard, K.B.; Benenson, W.; Clayton, J.; Kashy, E.; Lampis, A.; Morrissey, D.J.; Samuel, M.; Smith, R.J.; Tam, A. . (Michigan State Univ., East Lansing). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The authors present here the results from the first systematic study of high energy gamma ray emission in intermediate energy heavy ion collisions. Gamma ray energy and angular distribution have been measured for high energy gamma rays (10-120 MeV) from collisions of ^{14}N on Pb, Zn and C at beam energies of 20A, 30A and 40A MeV.

14856 (CONF-860270—, pp 132-134) **Multifragmentation in intermediate energy heavy ion collisions.** Jacak, B.V.; Britt, H.C.; Claesson, G.; Doss, K.G.R.; Ferguson, R.; Gavron, A.I.; Gustafsson, H.A.; Gutbrod, H.; Harris, J.W.; Kampert, K.H. (Los Alamos National Lab., NM). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

There has been considerable recent interest in the production of intermediate mass fragments ($A > 4$) in intermediate and high energy nucleus-nucleus collisions. The mechanism for production of these fragments is not well understood and has been described by models employing a variety of assumptions. Some examples are: disassembly of a system in thermal equilibrium into nucleons and nuclear fragments, liquid-vapor phase transitions in nuclear matter, final state coalescence of nucleons and dynamical correlations between nucleons at breakup. Previous studies of fragment production, with one exception, have been single particle inclusive measurements; the observed fragment mass (or charge) distributions can be described by all of the models above. To gain insight into the fragment production mechanism, the authors used the GSI/LBL Plastic Ball detector system to get full azimuthal coverage for intermediate mass fragments in the forward hemisphere in the center of mass system while measuring all the light particles in each event. The authors studied the systems 200 MeV/nucleon Au + Au and Au + Fe.

14857 (CONF-860270—, pp 148-150) **Flow of nuclear matter.** Poskanzer, A.M.; Doss, K.G.R.; Gustafsson, H.A.; Gutbrod, H.H.; Kampert, K.H.; Kolb, B.; Lohner, H.; Ludewigt, B.; Ritter, H.G.; Warwick, A. (Gesellschaft fur Schwerionenforschung, Darmstadt, West Germany). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The study of the nuclear matter equation of state is a prime objective of high energy heavy ion physics. It should be possible to achieve this goal by measuring all the relevant thermodynamic quantities, like temperature, entropy and density, simultaneously. Since the authors do not know how to measure the density at the point of maximal compression directly, they have to retreat to more indirect observables. Collective flow of nuclear matter upon reexpansion has been proposed as the most important signature for the compression effects predicted by an equation of state. Collective flow has been observed in Nb + Nb collisions at 400 MeV per nucleon measured with the Plastic Ball. Two collective effects, the side-splash of the participants and the bounce-off of the spectator nucleons have been established. Collective flow has been observed as well in collisions of asymmetric target projectile-combinations measured with the Streamer chamber. Data on collective flow for symmetric collisions of Ca, Nb, and Au measured with the Plastic Ball spectrometer at the Bevalac are presented. The events are analyzed both with the kinetic energy flow method and the transverse momentum method.

14858 (CONF-860270—, pp 151-154) **Collective flow of pions produced in nucleus-nucleus collisions.** Keane, D.; Beavis, D.; Chu, S.Y.; Fung, S.Y.; Gorn, W.; Liu, Y.M.; VanDalen, G.; Vient, M. (Univ. of California, Riverside). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The search for fluid-like collective behavior has been a major objective of past analyses of relativistic heavy ion data from 4 π detectors, and the existence of a flow signature among the final state charged baryons has by now been firmly established. In this study, the transverse momentum method of flow analysis has been adopted. Evidence has been found that negative pion emission from relativistic nucleus-nucleus interactions is correlated with the event reaction plane, as determined from the final state nucleons. In a mass-symmetric system (Kr on RbBr), the pattern of pion flow is bidirectional, while for two mass-asymmetric systems (Ne on BaI_2, Ar on Pb), a unidirectional pion flow has been observed which is quite different from the pattern of nucleon flow in these systems.

14859 (DOE/ER/03496—80, pp 8-32) **Nuclear transport phenomena in low-energy heavy-ion collisions.** Huizenga, J.R.; Schroeder, W.U. (Univ. of Rochester, NY). Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

The characteristic properties of a new nuclear reaction mechanism induced in low-energy heavy-ion collisions are discussed. Collision dynamics and final fragment production are indic-

ative of transport processes occurring in nuclear matter far from equilibrium. These relaxation mechanisms are mediated dominantly by the exchange of independent nucleons between the reaction partners.

14860 (INIS-SU—392, pp 308) **Study on the sup(197)Au(p,n)sup(197)Hg reaction mechanism.** Lovchikova, G.N.; Sal'nikov, O.A.; Trufanov, A.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14861 (INIS-SU—392, pp 309) **Residual nucleus production in the relativistic proton interaction with sup(197)Au nuclei.** Buttsev, V.S.; Vasil'ev, S.E.; Kozma, P.; Tumehndehmbehrehl, B.; Khorolzhav, R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14862 (INIS-SU—392, pp 310) **Study on the residual nucleus production in the 9 GeV/c proton interaction with sup(209)Bi nuclei.** Buttsev, V.S.; Vasil'ev, S.E.; Kozma, P.; Tumehndehmbehrehl, B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14863 (INIS-SU—392, pp 342) **Inclusive spectra of particles with Z<=2 in the reactions with 50 MeV /sup 3/He ions and α-particles on /sup 197/Au nucleus.** Adodin, V.V.; Blekhman, A.M.; Burtebaev, N.T.; Dujsebaev, A.D.; Ivanov, G.N.; Kanashevich, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14864 **Isomer shift of the 2.61 MeV gamma-ray transition in muonic ^{208}Pb.** Shera, E.B.; Hoehn, M.V.; Wagner, L.K.; Yamazaki, Y.; Steffen, R.M.; Krane, K.S. (Los Alamos Scientific Lab., NM). *Physics Letters* [*Section*] *B;* **67B**: No. 1, 26-28(14 Mar 1977).

The isomer shift of the 2.61 MeV γ-ray transition in ^{208}Pb has been measured as 6.25 +/- 0.28 keV. This result is in disagreement with interpretation of the 3^- state as a one-phonon octupole vibration. 19 references, 1 figure.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

14865 (CONF-860270—, pp 17-21) **Fragmentation for ^{235}U(n,f) and ^{252}Cf(SF).** Budtz-Jorgensen, C.; Knitter, H.H.; Straede, C.; Hambsch, F.J. (Commission of the European Communities, Geel, Belgium). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The fission processes ^{235}U(n,f) and ^{252}Cf(SF) have been long-standing themes of scientific investigation. Both reactions have important practical applications and at CBNM these reactions are studied since they are used as primary standards for neutron fluence determination (^{235}U) and neutron detector efficiency calibration (^{252}Cf). The efforts and techniques made at CBNM in order to improve the knowledge of these standards have led to results which contribute also to the basic research on the fission process. The most recent of these results is the subject of the present contribution.

14866 (CONF-860270—, pp 102-107) **Source properties of intermediate mass fragments emitted in the 270-MeV ^{3}He + ^{232}Th reaction.** Fatyga, M.; Byrd, R.; Kwiatkowski, K.; Wilson, W.G.; Woo, L.W.; Viola, V.E. Jr.; Karwowski, H.J.; Jastrzebski, J.; Skulski, W. (Indiana Univ., Bloomington). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The purpose of this experiment was to investigate the momentum balance associated with intermediate mass fragments with (IMF) emission and thereby evaluate the extent to which decay occurs from a system with the maximum available excitation energy. To achieve this experimental goal, triple coincidences were measured between IMF ejectiles and angle-correlated binary fission fragments produced in the reaction of E/A = 90 MeV ^{3}He ions with a ^{232}Th target. From these data it is possible to perform an analysis for missing momentum.

14867 (CONF-860270—, pp 108-112) **Emission of energetic protons at backward angles in central collisions.** Skulski, W.; Fatyga, M.; Kwiatkowski, K.; Karwowski, H.; Woo, L.W.; Viola, V.E. (Indiana Univ., Bloomington, IN). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Spectra of protons emitted in the backward hemisphere have been measured in coincidence with angle-correlated fission fragments for reactions of intermediate energy ^{3}He, ^{4}He and ^{6}Li projectiles with uranium target nuclei. Beam energies were E/A = 21.3, 43.0, 66.7 and 90.0 MeV for ^{3}He, E/A = 25.0 MeV for ^{6}Li and E/A = 20.0 and 40.0 MeV for ^{4}He. Energetic light-charged particles were detected with a particle identification telescope consisting of a 400-μm silicon surface barrier ΔE element and a 5-cm-thick NaI E detector in the ^{3}He and ^{6}Li experiments. For all systems it was found that protons dominated the yield of energetic charged particles observed in the particle identification telescopes at backward angles. In addition, the fission fragment folding angle distributions associated with these protons were found to be consistent with large linear momentum transfers in the projectile-target interaction.

14868 (INIS-SU—392, pp 382) **Experimental determination of the /sup 22/Ne+/sup 238/U fission reaction duration.** Bugrov, V.N.; Vinogradov, V.G.; Karamyan, S.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14869 (INIS-SU—392, pp 383) **Angular distribution of fission fragments and fission reaction duration.** Karamyan, S.A.; Bugrov, V.N.; Spiridonov, N.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14870 (INIS-SU—392, pp 311) **(p,3n) and (p,n) reactions on sup(238)U anti the proton energy of 7-30 MeV.** Ageev, V.A.; Golovnya, V.Ya.; Gromova, E.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14871 **(LA-UR—86-4136) Nuclear transitions induced by atomic excitations.** Bounds, J.A.; Dyer, P.; Haight, R.C. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 4p. (CONF-861038—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003724.

From OSA/APS international laser science conference; Seattle, WA, USA (20 Oct 1986).

In the two-step pumping scheme for a gamma-ray laser, an essential step is that of exciting the nucleus from a long-lived storage isomer to a nearby short-lived state that then decays to the upper lasing level. For a crystalline structure host, the radiation must be used efficiently so as not to destroy the crystal. High intensity sources of photons are available only for relatively low quantum energy, but it is difficult to couple a long-wavelength photon directly to the much smaller nucleus. An experiment is proposed to induce this transfer by first exciting the atomic electrons. The nuclear excitation should occur by the exchange of a virtual photon in the near field of the electrons. As a test case, the 73 eV /sup 235m/ U isomer might be excited by electronic motions induced by a high-brightness uv laser. The conversion electrons from the decay of the isomer would be detected and a 26 minute decay curve would indicate induced nuclear transitions. 5 refs.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 14506, 14591, 14593, 14628, 14656, 14693, 14702, 14752, 14758, 14820, 14831

14872 **(CEA-CONF—8262) Quasi-elastic heavy-ion transfer reactions from the Coulomb barrier up to several tens MeV/u.** Mermaz, M.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Jan 1986. 35p. (CONF-860191—1; DPH-N-S—2313). NTIS (US Sales Only), PC A03/MF A01. File Number DE87750765.

From 9. OAXTEPEC symposium on nuclear physics; Mexico City, Mexico (2 Jan 1986).

Quasi-elastic transfer reactions populating the continuum states will be analyzed in terms of diffractional model calculations. Optimum Q value predictions will be compared to the data. Competition with other processes such as fragmentation or break-up will be also presented.

14873 (CONF-860270—, pp 124-127) **Definition and measurement of entropy in high energy heavy ion collisions.** Remler, E.A. (College of William and Mary, Williamsburg, VA). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

This talk has two parts: the first on the definition and the second on the measurement of entropy. The connection to nuclear thermodynamics can be retained without the local equilibrium assumption via two steps. The first is relatively simple and goes as follows. The authors make the certainly reasonable assumption that in central collisions, at the moment of maximum compression, the state is similar to one or more fireballs and that the total entropy of each fireball approximates that of an equilibrated system at the same total energy and average density. This entropy, if measurable, would determine much of the thermodynamic properties of nuclear matter. The second step therefore concerns measurement of this entropy. This paper develops a method by which entropy may be measured using a minimum amount of theory. In particular, it is not based on any assumption local equilibrium.

14874 (CONF-860270—, pp 135-138) **Microcanonical simulation of nuclear disassembly.** Koonin, S.E.; Randrup, J. (California Institute of Technology, Pasadena). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123. Contract AC03-76SF00098.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

There is considerable interest in the disassembly of the hot nuclear matter produced in high-energy nuclear collisions. A particular stimulus has been the prospect of observing a nuclear liquid-gas phase transition. On rather general grounds, such a transition is expected to occur in nuclear matter at subsaturation densities with temperatures of 10-20 MeV. However, virtually all previous discussions of this phenomenon have been based on thermodynamical considerations valid for infinite, non-interacting systems and the qualitative validity of the results has not been ascertained for the relatively small, finite, interacting systems of practical relevance. Nor is it clear how the occurrence of the phase transition will manifest itself in the asymptotically observed fragment distribution. To progress in these matters, the authors have formulated a microcanonical simulation of the disassembly process, including interfragment interactions. It is a natural refinement of the grand canonical model first presented in [1] and further developed in [2] and is also a exact version of the model developed in [3] for the generation of complete multifragment events in medium-energy collisions. In this contribution, the authors give a brief description of the key ingredients in the model and its numerical implementation.

14875 (CONF-860270—, pp 1-4) **New picture of dissipation in fission and heavy-ion reactions.** Nix, J.R.; Sierk, A.J. (Los Alamos National Lab., NM). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Waldek and his colleagues derived a simple wall formula for describing one-body dissipation in which nuclei are predicted to be superviscid. This formula provides the starting point for this investigation. Replacing several idealizations of the wall formula with more realistic features reduces the one-body dissipation predicted by the wall formula substantially. For dumbell-like shapes dissipation is similar to that given by Waldek's classic wall formula. Results for the width of the giant resonance for all mass numbers, fission of plutonium 240 and fission fragment kinetic energies as a function of mass number are compared with experimental data.

14876 (CONF-860270—, pp 5-9) **Autonomous quantal dissipation and the wall formula.** Griffin, J.J.; Dworzecka, M. (Univ. of Maryland, College Park). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Autonomous quantal (AQ) collective vibrations and their dissipation into incoherent states within a subspace of the 1 particle-1 hole excitations have been studied in a model nuclear system using the methods of Yannouleas. The goal of the study was to exhibit the collective dissipation in terms of the coupling via s two-body interaction between an approximate collective state and a set of 1p-1h states lying outside of the RPA diagonalized subspace. Results are compared to those predicted by the classical wall formula. The wall formula appears to substantially overestimate the dissipation rate as can be seen from comparison of AQ and wall formula predictions for the width of the giant quadrupole resonance as a function of mass number with experimental data.

14877 (CONF-860270—, pp 13-16) **Tilting mode in nuclear reactions.** Dossing, T.; Randrup, J. (Lawrence Berkeley Lab., CA). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Within the last few years, the problem of compound nucleus fission angular distributions has received renewed interest. Empirical evidence has led to the suggestion that fission fragment angular distributions are determined by the level densities and transmission coefficients associated with the scission shape. The scission shape ansatz for angular distributions rests on the assumption that the time for descent from saddle to scission is long compared to the time scale for attaining an equilibrium distribution of orientations. The time scale in question is the relaxation time of the tilting mode. The present note gives a discussion of this relaxation time. First the relation between tilting relaxation and the reaction plane dynamics is discussed, providing an intuitive understanding of the expression for the cross section close to the beam direction, which has recently been derived. Second, the tilting relaxation time and the related wriggling relaxation time are discussed, based upon nucleon exchange transport (window friction). Finally, recent experimental information on the tilting mode relaxation is discussed, and the dynamics of the tilting mode is discussed qualitatively for the three different types of nuclear reactions considered, compound nucleus fission, quasifission, and damped nuclear reactions.

14878 (CONF-860270—, pp 40-43) **Nuclear polarization potential due to particle transfer in heavy-ion collisions.** Landowne, S.; Dasso, C.H.; Winther, A.; Pollarolo, G. (Argonne National Lab., IL). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

The effective interaction which determines the elastic scattering of heavy composite systems consists of a bare real potential V, normally identified with the folding model, a renormalization term or polarization potential ΔV and an imaginary absorptive potential iW. The latter contributions originate from the couplings to intrinsic degrees of freedom. While iW is a conspicuous feature of all optical model analyses, the related term ΔV has received relatively little attention until recently. Here the authors examine the microscopic structure of ΔV + IW using second-order semi-classical perturbation theory. In particular, they focus on the long-range part of ΔV which is governed by single-particle transfer reactions between the colliding systems.

14879 (CONF-860270—, pp 48-51) **Statistical description of orbiting and fusion.** Ayik, S.; Shivakumar, B.; Shapira, D.; Harmon, B.A. (Tennessee Technological Univ., Cookeville). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

In the present work, the authors propose an extension of the diffusion model for describing the intermediate processes and the compound nucleus formation in heavy ion collisions. The model describes the intermediate processes and fusion in terms of the formation and the evolution of a long-lived dinuclear molecular complex (DMC) and its subsequent decay by fragmentation. The colliding ions can be trapped into the pocket of the entrance channel nucleus-nucleus potential and a DMC is formed. This DMC acts as a doorway state towards formation of a completely equilibrated compound nucleus (CN). It evolves through the exchange of nucleons to different dinuclear configurations. At each stage of its evolution, there is a finite probability to emit fragments into outgoing channels by thermal penetration over the barrier. The doorway states that do not fragment relax into a CN configuration and are identified as the fusion yield. The model, at the equilibrium limit, is successfully applied to analyze the orbiting and fusion data in Si + C collisions.

14880 (CONF-860270—, pp 52-56) **Ambiguities in the description of nucleon transfer in deep inelastic scattering.** Dworzecka, M.; Zielinska-Pfabe, M.; Griffin, J.J. (George Mason Univ., Fairfax, VA). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Here the authors discuss certain ambiguities which are in the description of (N,Z) evolution in heavy ion collisions by means of nucleon exchange models. Such descriptions have been formulated either in terms of Markovian Master (MM) equations (or its approximate version in the form of Fokker-Planck equation) in terms of transition rates per unit time, or in terms of Random Walk (RW) on the energy surface in terms of transition probabilities per nucleon exchanged. In a series of papers they have shown that the RW is the useful tool in studying probability distributions of particle numbers (protons and neutrons) as a function of energy loss. The authors purpose was to compare the implications of different (often competing) physical mechanisms for specific features of the (N-Z) distribution. One result of that analysis was that not all of the kinetic energy loss could be attributed to the nucleon transfer process assumed; rather, an additional step had to be allowed in the random walk in which no nucleon is transferred, but kinetic energy is lost nonetheless. Only then could the total width, σ/sub A/^{2}, of the (N-Z) distribution (as a function of energy loss) be made to conform with the experimental data. Conversely requiring this conformance yielded a specific value of the average relative probability for this additional non-transfer step.

14881 (CONF-860270—, pp 120-123) **Collective flow in central Ca + Ca and Nb + Nb collisions.** Fai, G.; Csernai, L.P.; Kapusta, J.I. (Kent State Univ., OH). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Questions related to the entropy, equation of state and collective flow of nuclear matter are important to the authors understanding of high energy nuclear collisions. Completion of the analysis of exclusive measurements on central Ca + Ca and Nb + Nb collisions triggered renewed interest in these problems. In order to address the results of exclusive measurements, however, the complex multifragment final states of high energy nuclear collisions need to be incorporated in a theoretical description. The microcanonical event generator model provides statistically generated complete events that can be compared to the exclusive data on an event-by-event basis. To describe the disassembly of hot nuclear matter the model uses an approximate scheme in which the available final states are populated according to their microcanonical weight in phase space. This statistical description is front-ended with simple geometric ideas to divide the collision system into subsystems and with a prescription to share energy and momentum among the subsystems. Any physical quantity of interest is in principle calculable in the model if sufficient statistics is accumulated.

14882 (CONF-860270—, pp 26-29) **Masses and decay properties of nuclei far from stability.** Moeller, P.; Nix, J.R.; Myers, W.D.; Swiatecki, W.J. (Los Alamos National Lab., NM). Apr 1986. NTIS, PC A08/MF A01. File Number DE86009123.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

In 1981 a macroscopic-microscopic calculation of 28 fission barriers and 4023 nuclear masses throughout the periodic system was performed with a folded-Yukawa single-particle potential and a Finite-Range microscopic model. A detailed analysis of the results showed that the model described well nuclear masses far from stability as well as other nuclear properties, for example the onset and magnitude of nuclear deformation. The above model has recently been applied to a study of the stability of elements in the heavy and superheavy regions. They show two results from this calculation. First, neutron changes for the predicted properties of the elements in the superheavy region are shown. In particular they now predict ^{288}X and ^{290}X to be the most stable elements in this region, both with a half-life of 200 days. Second, another interesting feature is the small local minimum around Z = 110 and N = 162. This minimum corresponds to deformed shapes and to an N = 162 gap in the deformed neutron single-particle level spectrum. The half-life of $_{110}{}^{272}$X is predicted to be 40 milliseconds.

14883 (DOE/ER/03496—80, pp 107-162) **Fission fragment angular distributions.** Rossner, H.; Huizenga, J.R.; Schroeder, W.U. (Hahn-Meitner-Institut-fuer Kernforschung, Berlin, West Germany). Aug 1986. NTIS, PC A13/MF A01. File Number DE85017572. (COO—3496-80).

In Studies of heavy ion reactions and transuranic nuclei. Progress report, September 1, 1984-August 31, 1985.

A statistical scission model (SSM) is developed and applied to fragment angular distributions from alpha- and heavy-ion-induced fission. Although the formal equations for fragment angular distributions in the statistical scission and transition state models are of the same structure, the variances in the distribution of angular momentum projections on the fission direction are established at very different stages of the fission process in the two models. The SSM predicts angular distributions in reasonable agreement with those measured for heavy-ion-induced fission of some reaction systems where the fission barrier was vanished or is very small relative to the nuclear temperature. For a number of these systems, the transition state model (TSM) is inapplicable. The SSM, however, predicts the variance to have too weak an energy dependence, possibly indicating dynamical effects. Inclusion of pre- and post-scission particle emission and asymmetric fission does not remove this discrepancy. The TSM gives a better representation of fragment angular distributions from alpha-particle-induced fission of several targets (low-spin systems) as a function of fissility parameter. The very large experimental variances, observed for systems with large spin and no fission barrier, are inconsistent with the concepts of fast or preequilibrium fission, occurring on a time scale too short for relaxation of the tilting mode. Fragment spins from γ-ray multiplicities are compared with predictions of the two above models.

14884 **(DOE/ER/04936—12) Nuclear spectroscopic studies: Progress report.** Bingham, C.R.; Guidry, M.W.; Riedinger, L.L.; Sorensen, S.P. (Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy). 31 Jan 1987. Contract AS05-76ER04936. 117p. NTIS, PC A06/MF A01. File Number DE87005301.

Research efforts of the University of Tennessee Nuclear Physics Group can be divided into five broad categories; the structure of nuclei at high angular momentum, nuclear structure and reactions with heavy ions, studies of low-energy levels of nuclei far from stability, nuclear physics with ultrarelativistic particles, and nuclear structure and reaction theory. Within these five broad categories, forty separate research projects are summarized. In addition, development and organization projects are reviewed and a list of publications is provided.

14885 **(DOE/ER/40015—1) Theoretical nuclear physics: Final report for period February 1, 1984 to January 31, 1987.** Rost, E.; Kunz, P.D. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). 23 Jan 1987. Contract AC02-81ER40015. 10p. NTIS, PC A02. File Number DE87004504.

Nuclear theory at the University of Colorado emphasizes the study of nuclear structure through the use of nuclear reactions. Recent efforts have been focussed on the role of relativistic models in nucleon-nucleus scattering and reactions. Further work delves into the underlying bases of the reaction theory itself.

14886 **(EIR—566) NJOY nuclear data processing system. The COLLGR, ECOMBR, SEPR, DICTR, MANAGR, EPLOTR, CPLOTR, and ACOMBR modules.** Pelloni, S.; Higgs, C.; Stepanek, J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Aug 1985. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780505.

The NJOY nuclear data processing system was developed at Los Alamos. It consists of modules to produce neutron and photon pointwise, groupwise, and problem oriented cross section libraries. The practical use of this system has shown the need for additional modules for the collapsing of groupwise files, combining of ENDF/B formatted files, separation of one file, plotting of cross sections or differences between two cross section files, combining ACE cross section files, etc. Such modules were therefore developed at EIR and are described in the present paper.

14887 (INIS-SU—392, pp 205) **Semiclassical approximation for density matrix.** Strutinskij, V.M.; Magner, A.G.; Vydrug-Vlasenko, S.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14888 (INIS-SU—392, pp 62) **Mixing /sup 78/Se three states and the structure of its high spin states.** Lemberg, I.Kh.; Shuvaev, A.G.; Shvengner, R.; Funke, L. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14889 (INIS-SU—392, pp 81) **Analysis of g-factors of even-even nuclei 2/sub 1//sup +/ states in the 44 < Z < 76 and 56 < N < 114.** Kuznichenko, A.V.; Lebedev, V.N.; Onishchenko, G.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14890 (INIS-SU—392, pp 106) **On the amplification of high-energy gamma transitions in capture of 2 KeV neutrons by a sup(143)Nd nucleus.** Veselov, G.V.; Mezilev, K.A.; Novikov, Yu.N.; Popov, A.V.; Sergienko, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14891 (INIS-SU—392, pp 108) **Alpha and gamma transitions in the vicinity of sup(146)Gd.** Artamonov, S.A.; Isakov, V.I.; Lomachenkov, I.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14892 (INIS-SU—392, pp 109) **On the sup(148)Ce -> sup(148)Pr decay.** Bugrov, V.P.; Byalko, A.A.; Volkov, N.G.; Slyusarenko, A.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14893 (INIS-SU—392, pp 111) **Probabilities of E1-transitions de-exciting the 11/2/sup -/(505) isomeric state in odd-neutron nuclei at N > 89.** Alikov, B.A.; Badalov, Kh.N.; Gromov, K.Ya. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14894 (INIS-SU—392, pp 112) **Deformation parameters of sup(154)Eu.** Guseva, T.V.; Tamberg, Yu.Ya.; Balodis, M.K. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14895 (INIS-SU—392, pp 114) **M1 + E2 + E0 transitions in sup(155)Tb and sup(155)Gd nuclei.** Abdurazakov, A.A.; Gromov, K.Ya.; Islamov, T.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14896 (INIS-SU—392, pp 116) **Description of high-excited states in deformed and transient nuclei.** Belen'kij, V.M.; Zalyubovskij, I.I.; Kuznichenko, A.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14897 (INIS-SU—392, pp 124) **Probabilities of electromagnetic transitions in odd-thilium nuclei.** Adam, I.; Alikov, B.A.; Badalov, Kh.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14898 (INIS-SU—392, pp 136) **On the quadrupole moments of the 2sup(+)sub(1) level in sup(196)Pt.** Mikhajlov, V.M.; Sergeev, V.O.; Tulina, T.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14899 (INIS-SU—392, pp 147) **Microscopic estimation of clusterization in light nuclei.** Zelevinskij, V.G.; Mazepus, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14900 (INIS-SU—392, pp 148) **Generating matrix elements of Hamiltonian of algebraic version of the resonating-group method with different oscillator radii.** Badalov, S.A.; Filippov, G.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14901 (INIS-SU—392, pp 159) **Optical-shell approach to analysis of the partial E1 radiative strength functions of compound resonances.** Bondarenko, V.I.; Urin, M.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14902 (INIS-SU—392, pp 167) **sub(8)sup(16)O as the set of the deuteron pairs.** Trajdos, M. 1986. NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14903 (INIS-SU—392, pp 170) **Study on the matrix elements of electromagnetic and β transitions within the Wigner scheme.** Petrauskas, A.K.; Bondarenko, V.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14904 (INIS-SU—392, pp 181) **Isoscalar spin-spin interaction in the quasiparticle-phonon model.** Vdovin, A.I.; Dao Tien Khoa; Ponomarev, V.Yu. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14905 (INIS-SU—392, pp 185) **Difference method application to calculation of neutron-rich nucleus masses.** Matveev, G.V.; Yavshits, S.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14906 (INIS-SU—392, pp 191) **U(6/12) supersymmetric scheme in the interacting boson and Fermion model.** Smirnov, Yu.F.; Istomina, I.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14907 (INIS-SU—392, pp 194) **Low-lying nonrotational states of sup(172)Yb.** Nesterenko, V.O.; Sushkov, A.V.; Shirkova, N.Yu. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14908 (INIS-SU—392, pp 196) **Development of SU(4) symmetry conception in nuclear physics.** Vladimirov, D.M.; Gaponov, Yu.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14909 (INIS-SU—392, pp 198) **On the problem of the 2p2h configuration account for the Lipkin-Meshkov-Glick model.** Tselyaev, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14910 (INIS-SU—392, pp 199) **Equilibrium deformation change of ground and excited states in light nuclei.** Korda, L.P.; Kopanets, E.G.; Khomyakov, G.K.; Kachan, A.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14911 (INIS-SU—392, pp 200) **On the number of bound states for given superposition of the centrifugal, Coulomb repulsive and nuclear potentials.** Poplavskij, I.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14912 (INIS-SU—392, pp 201) **Collective motion in nuclei according to the gas-droplet model.** Magner, A.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14913 (INIS-SU—392, pp 202) **Macroscopic dynamics of high-excited nuclear states.** Strutinskij, V.M.; Abrosimov, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14914 (INIS-SU—392, pp 204) **Boundary conditions for semiclassical distribution function.** Magner, A.G. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14915 (INIS-SU—392, pp 206) **Isoscalar and isovector giant multipole resonances in deformed nuclei in the frameworks of the gas-drop nuclear model.** Denisov, V.Yu. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14916 (INIS-SU—392, pp 209) **Energies of multi-quasiparticle states in method with precise conservation of particle number.** Kuz'menko, N.K.; Nesterenko, V.O.; Mikhajlov, V.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14917 (INIS-SU—392, pp 211) **Interaction of particle(Hole)-core in a sup(147)Gd nucleus.** Kaminskij, V.A.; Vavryshchuk, Ya. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

14918 (INIS-SU—392, pp 212) **Quasiparticle states of odd-odd actinide nuclei.** Egorov, S.A.; Rubchenya, V.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

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15057 (INIS-SU—392, pp 416) **Angular correlations of light particles and fission fragments of daughter nucleus.** Aleshin, V.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15058 (INIS-SU—392, pp 430) **Cluster evaporation from excited compound nuclei.** Muzychka, Yu.A.; Pustyl'nik, B.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15059 (INIS-SU—392, pp 437) **Structure effects in the nuclear decay with heavy fragment escape.** Kadmenskij, S.G.; Furman, V.I.; Chuvil'skij, Yu.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15060 (INIS-SU—392, pp 452) **On light fragment spontaneous exit from nuclei.** Grashin, A.F.; Efimenko, A.D. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15061 (INIS-SU—392, pp 446) **Dynamic of distribution formation of compound nucleus fission fragments with large angular momentum.** Adeev, G.D.; Marchenko, L.A.; Pischakov, N.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15062 (INIS-SU—392, pp 208) **Hartree-Fock description of deformed thulium isotope properties.** Barzhakh, A.E.; Starodubskij, V.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15063 (INIS-SU—392, pp 581) **Polarization density matrix of the spinless nuclei excited by polarized neutrons.** Lifshits, E.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15064 (INIS-SU—392, pp 583) **Statistical functional of an energy of a nucleus in a noninteracting quasi particle model.** Tyapin, A.S. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15065 (INIS-SU—392, pp 539) **Fine structure of energy dependece of cross section of relativistic nuclei coherent Coulomb excitation in crystals.** Pivovarov, Yu.L.; Shirokov, A.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15066 (INIS-SU—392, pp 567) **Mechanisms of Coulomb excitation of nuclei flying through crystals.** Pivovarov, Yu.L. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15067 (INIS-SU—392, pp 579) **Deuteron scattering on light nuclei.** Kvitsinskij, A.A.; Kuperin, Yu.A.; Latypov, D.M.; Merkur'ev, S.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15068 (INIS-SU—392, pp 295) **Characteristics of the resonances in elastic and inelastic scattering of protons on /sup 28/Si at Esub(p) approximately 6 MeV.** Sheberg, A.; Brenner, M.; Chubinskij, O.V.; Kangropol', Yu.V.; Vinogradov, L.I.; Lazarev, V.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15069 (INIS-SU—392, pp 343) **Study on the positions and occupancies of nucleon subshells of intermediate nuclei.** Boboshin, I.N.; Varlamov, V.V.; Ishkhanov, B.S.; Kapitonov, I.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15070 (INIS-SU—392, pp 345) **Analysis and estimation of the cross sections of the /sup 7/Li nucleus photodisintegration channels in the giant resonance region.** Varlamov, V.V.; Ishkhanov, B.S.; Chernyaev, A.P.; Ehramzhyan, R.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15071 (INIS-SU—392, pp 347) **Method for estimation of the photonuclear reaction partial cross sections.** Ishkhanov, B.S.; Kapitonov, I.M.; Mokeev, V.I.; Piskarev, I.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15072 (INIS-SU—392, pp 420) **Quasiclassical description of multistage processes and introduction of friction forces in the quantum theory of collisions.** Zagrebaev, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15073 (INIS-SU—392, pp 532-533) **On the calculation accuracy of the neutron yields from chemical actinide compounds.** Vukolov, V.A.; Chukreev, F.E. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15074 **(LA-UR—86-3455) Three-body calculations at Los Alamos.** Friar, J.L. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 11p. (CONF-8610196—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87001959.

From European workshop on few body physics; Rome, Italy (7 Oct 1986).

This work was motivated by four goals: (1) by working in configuration space, where intuition is greatest, investigate graphically those trinucleon properties which are determined by specific features of wave functions; (2) produce benchmark calculations against which new techniques and numerical methods can be measured; (3) investigate the effect of the Coulomb interaction between the two protons in ^{3}He and in the p-d system; (4) systematically investigate the various trinucleon observables. Configuration space is particularly well-suited for investigating the Coulomb problem. The singularity and discontinuity problems associated with the Coulomb (momentum space) t-matrix are transformed into boundary condition problems in configuration space. One simply adds the Coulomb potential to the strong interaction. In order to produce accurate numerical solutions powerful techniques were adopted which have not frequently been used in nuclear physics. These spline methods together with collocation techniques combine the

power of Gaussian quadrature procedures with the flexibility and strength of finite element approaches to solving partial differential equations. The union of these methods allows one to calculate wavefunctions at the same qualitative level of accuracy as the eigenvalues. Observables can therefore be calculated with considerable confidence. 30 refs., 6 figs.

15075 **(LA-UR—86-4172) Microscopic theory of multiple scattering for open shell nuclei.** Johnson, M.B.; Singham, M.K. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 23p. (CONF-8609209—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003730.

From Workshop on the relations between structure and reactions in nuclear physics; Philadelphia, PA, USA (15 Sep 1986).

The scattering of a distinguishable projectile from a nucleus is considered assuming that the underlying interaction Hamiltonian is a sum of two-body potentials. The effective interaction of the projectile with the nucleus in a truncated nuclear model space can be calculated as a linked cluster expansion. The shell-model interaction is required to be an energy-independent, hermitian potential; its expression is terms of the underlying two-body potential is given by folded diagrams. The terms in the expansion of the effective projectile-nucleus interaction must also contain folded diagrams but, unlike the shell-model potential, these are energy dependent in order to describe the singularities associated with the crossing of the scattering thresholds as the projectile energy is varied. Once the effective interaction is known, elastic and inelastic scattering may be evaluated numerically by solving a finite-dimensional coupled-channel equation. 24 refs., 12 figs.

15076 **(PCCF-T—85-02) Study of the hadron-helium and helium-helium scattering at high energy.** Jargeaix, B. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-1 Univ., 63 - Aubiere (France)). 1985. 330p. (In French). NTIS (US Sales Only), PC A15/MF A01. File Number DE87750755.

Multiple scattering Glauber's theory is used to calculate the hadron-helium and helium-helium elastic differential cross-section. The theory is very sensitive to the ^{4}He wave functions. We use better ^{4}He wave functions than experimental ones. These wave functions have correct asymptotic shape. In some calculations, we take into account the spin effects and the ^{4}He, S, S' and D states contribution. At high energy, we use inelastic corrections, to complete the differential cross-section. A study of the diffractive and coherent $p^-{}^4He \rightarrow {}^4He\text{-}X$ dissociation is developed. We use Humble's amplitudes with a peripherical character and an helicity structure. The agreement with experimental results is good for 24 to 400 GeV.

15077 **(TRI-PP—86-103) The LLEE [Lorenz-Lorentz-Ericson-Ericson] effect at low energies.** Jennings, B.K. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1986. 3p. (CONF-8609163—6). NTIS (US Sales Only), PC A02. File Number DE87900321.

From International conference and symposia on unified concepts of many-body problems; Stony Brook, NY, USA (4 Sep 1986).

Until recently there has been no direct phenomenological evidence on the density dependence of the π-nucleus optical potential. This has changed with the recent data on the excited 0^+ states which constrain the density dependence and gives strong support for the Lorenz-Lorentz-Ericson-Ericson effect and the suppression of multiple scattering in the nuclear medium. 15 refs., 5 figs.

15078 **Baryon deformations and excitations in the Skyrme model.** Schwesinger, B.; Hajduk, C. (Dept. of Physics, State Univ. of New York, Stony Brook, NY 11794). pp 129-141 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

The excitation energies of the Roper resonance and the stability of baryons against static quadrupole deformations are studied in the Skyrme model. Nucleon and Δ-isobar turn out to be spherical. States having a spin different from their isospin are strongly deformed and lie $\approx$500 MeV above the ground states. The Roper is the lowest excitation of the Skyrme soliton located at $\approx$300 MeV excitation energy.

15079 **Nuclear non-perturbative excitations.** Boguta, J.; Kunz, J. (Accelerator and Fusion Research Div., Lawrence Berkeley Lab., Berkeley, CA 94720). pp 220-234 of Solitons in nuclear and elementary particle physics. Chodos, A.; Hadjimichael, E.; Tze, C. Philadelphia, PA; World Scientific Pub. Co. (1985). (CONF-8406178—).

From Workshop on solitons in nuclear and elementary particle physics; Lewes, DE, USA (2 Jun 1984).

A nucleus is a many body system in which a rich variety of structures is realized. Nuclear rotations, vibrations, isotopic spin excitations, delta resonance formation and lambda hypernuclei are just a part of the diverse physics realiable in a nucleus. Conventional nuclear physics concerns itself primarily with baryonic degrees of freedom. The nucleus is described as a non-relativistic system of nucleons, which is governed by the Schrodinger equation. Nucleons interact in this framework via static two-body potentials, mesonic degrees of freedom are neglected. However, although this conventional approach has usually been very successful, the validity of its basic assumptions is questionable.

15080 **Relativistic projectile fragment interactions: anomalons.** Karol, P.J. (Carnegie-Mellon Univ., Pittsburgh, PA). *Science (Washington, D.C.);* **226**: 1425-1427(21 Dec 1984).

Interaction mean free paths are calculated for projectile fragments from relativistic heavy-ion interactions in emulsions and plastic. There are important discrepancies between emulsion results and those from other techniques. Anomalous secondaries (anomalons) may prove to be interpretable by conventional nuclear physics: short mean free paths may be due to convoys of collinear light fragments from peripheral interactions (for example, with neutrons) or from low-excitation particle-unbound fragments that decay in flight. 16 references, 1 figure, 1 table.

15081 **Assessment of approximations made in breakup-fusion descriptions.** Li, X.H.; Udagawa, T.; Tamura, T. (Univ. of Texas, Austin). *Physical Review [Section] C: Nuclear Physics;* **30**: No. 6, 1895-1903(Dec 1984).

Three methods for calculating the breakup-fusion cross sections are compared; the authors, and those of Baur and Trautmann and of Kasano and Ichimura. All three use the two-step and the spectator approximations. It will be shown first that, while the authors does not make any further approximation, the other two make a few additional approximations. Errors caused by these additional approximations are assessed numerically. The errors are found rather large in general. A critical assessment of the formalism by Austern and Vincent, on which the work of Kasano and Ichimura was based, is also made. 17 references, 4 figures.

15082 **One effect of using relativistic kinematics in the analysis of heavy-ion elastic scattering.** Farid, M.E.; Satchler, G.R. (Oak Ridge National Lab., TN). *Physics Letters [Section] B;* **146B**: No. 6, 389-391(25 Oct 1984). Contract AC05-84OR21400.

The ion-ion potential deduced from an optical model analysis of heavy-ion elastic scattering may be sensitive to whether the transformation from laboratory to center-of-mass system used is relativistic or not. For illustration, a semiclassical description is used to give a simple estimate of this effect and its dependence on energy and the masses of the nuclei. For example, the change in potential strength is larger than 20% for ^{40}Ar scattering from ^{208}Pb at an energy as low as 44 MeV per nucleon. 10 references.

15083 **Microscopic calculation for deformed nuclei.** Otsuka, T. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM 87545). pp 3-21 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—).

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

The microscopic basis of the Interacting Boson Model for deformed nuclei is discussed. The IBM Hamiltonian is constructed microscopically in the following two steps. In the first step, the collective nucleon pairs of J=0/sup +/ (S), 2/sup +/ (D), etc. are mapped onto the corresponding bosons. Nucleon-nucleon interactions are also mapped onto boson-boson inter actions. This mapping method for deformed nuclei was proposed recently, and it turned out that this method is consistent with the Hartree-Fock-Bogoliubov + angular momentum projection calculation. Low-lying collective states primarily consist of S and D pairs. Consequently, the corresponding boson states mainly consist of s and d bosons, while there are some admixture of g-bosons. In the second step, effects of these g-bosons are included within the s-d boson space by a unitary transformation which transforms a combination of d and g bosons into a new d-boson. By minimizing the coupling between "new" d and g bosons with an appropriate mixing angle, one can neglect the coupling and obtain the IBM Hamiltonian with s and d bosons. It is demonstrated that the s-d Hamiltonian thus derived indeed reproduces spectra of the original s-d-g Hamiltonian.

15084 **Medium energy probes and the IBM.** Ginocchio, J.N. (Los Alamos National Lab., Univ. of California, Theoretical Div., Los Alamos, NM 87545). pp 297-317 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—).

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

Medium energy scattering theory and the interacting boson model of nuclei (IBM) are combined so that the multiple scattering to intermediate IBM states is summed to all orders.

15085 **Axial asymmetry, finite particle number and the IBA.** Casten, R.F. (Brookhaven National Lab., Upton, NY 11973). pp 349-363 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—). Contract AC02-76CH00016.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

Although the IBA-1 contains no solutions corresponding to a rigid triaxial shape, it does contain an effective asymmetry. This arises from zero point motion in a γ-soft potential leading to a non-zero mean or rms γ. Three aspects of this feature will be discussed: 1) The relation between IBA-1 calculations and the corresponding γ. This point is developed in the context of the Consistent Q Formalism (CQF) of the IBA. 2) The dependence of this asymmetry on boson number, N, and the exploitation of this dependence to set limits on both the relative and absolute values of N for deformed nuclei. 3) The relation between this asymmetry and the triaxiality arising from the introduction of cubic terms into the IBA Hamiltonian. Various observables will be inspected in order both to determine their sensitivity to these two structural features and to explore empirical ways of distinguishing which origin of asymmetry applies in any given nucleus.

15086 **Historical perspective of the relation between IBA and VMI at the magic limit: Two opposing views.** Scharff-Goldhaber, G. (Brookhaven National Lab., Upton, NY 11973). pp 364-376 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—).

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

The two-parameter rotational VMI equations ascribe the observed abrupt change in yrast bands at the magic limit to a first order phase transition. In contrast, two three-parameter anharmonic vibrator models recently suggested yield two limits of validity, neither of which is supported by data.

15087 **Unpaired nucleons as probes of core collective fields.** Leander, G.A.; Semmes, P.B.; Donau, F. (UNISOR, Oak Ridge Associated Universities, Oak Ridge, TN 37830). pp 167-180 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—). Contract AC05-76OR00033.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

Field theory techniques are applied to the study of interacting boson systems. A dynamical quasiparticle theory derived by the equations of motion method is compared with IBFM as a means of coupling an odd particle to IBM cores. For a single j-shell, the two models are found to be roughly equivalent on a phenomenological level. This equivalence requires that the IBFM parameter Ao /sub is a function of the core, SU(5) vs. SU(3) or O(6), but not an explicit function of the Fermi level. IBFM is found to 'Coriolis attenuate' in strong-coupled bands - partly decoupled cases must be investigated further. The dynamical quasiparticle method has advantages with respect to (I) the physical significance of the pairing Δ as opposed to the IBFM Ajj'/'s, (II) particle transfer, at least in principle, and (III) easy generalizability. In an application of static mean field theory, the α-cluster interpretation of the SU(4) model for the Ra isotopes is tested. It is found that a larger cluster would be required to account for experimental odd-nucleon decoupling factors.

15088 **U(6/12) symmetry in the deformed region.** Warner, D.D. (Brookhaven National Lab., Upton, NY 11973). pp 139-154 of Interacting boson-boson and boson-fermion systems. Scholten, O. Philadelphia, PA; World Scientific Pub. Co. (1984). (CONF-8405231—). Contract AC02-76CH00016.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 May 1984).

The structure predicted in the SU(3) limit of the U(6/12) boson-fermion symmetry is discussed and compared with the equivalent region of the Nilsson scheme. An unambiguous link between the two frameworks can be established via a study of the single particle structure in each, and this connection points to a physical interpretation for the Casimir operators appearing in the U(6/12) group chain decomposition. The predictions of the symmetry scheme are shown to agree well with the low-lying structure of / sup 185/W. Possible future topics of interest stemming from these studies are also discussed.

15089 **Effect of triaxially deformed nuclear charge distribution on quadrupole parameters deduced from muonic X-ray experiments.** Tanaka, Y.; Steffen, R.M. (Purdue Univ., West-Lafayette, IN). *Nuclear Physics [Section] A;* **A382:** 513-527(1982). Contract AC02-76ER02875.

The influence of the assumed model charge density distribution in deducing nuclear quadrupole parameters from muonic X-ray experiments is investigated within the framework of the Davydov model. It is shown for the case of ^{192}Os that the extracted quadrupole parameters are not seriously affected by a triaxial deformation of the charge distribution. The model uncertainty involved in the muonic K and L X-ray analysis is estimated to be of the order of a few percent for the deduced quadrupole parameters of ^{182}Os. The results of the calculation also preclude the possibility that muonic X-ray measurements can be used to obtain information concerning triaxial deformations of nuclei. 21 references, 6 figures, 2 tables.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 13909, 14601

15090 **(AD-A—173030/8/XAB) Measurements of 14-MeV neutron propagation in an air-over-ground geometry. Research report, April-May 1984.** Heimbach, C.R.; Harrison, R.C.; Dhermain, J.; Laugier, J. (Army Combat Systems Test Activity (Prov.), Aberdeen Proving Ground, MD (USA)). Sep 1986. 21p. (USACSTA—6412). NTIS, PC A02/MF A01.

Measurements were made of the propagation of neutrons from a 14-MeV source into a free-field air-over-ground geometry. Neutron, gamma-ray, and total kerma were measured at distances ranging from 100 to 800 meters from the source. Agreement with calculations is satisfactory.

15091 (CONF-8410256—, pp 1-12) **Historical background and objectives of workshop.** 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

The Shelter Island Workshop was held to allow scientists from all the National Laboratories to determine the relative merits of pulsed and steady state neutron sources. Neutron scattering in condensed matter science and industrial applications were discussed. Fundamental studies of neutrons and neutron reactions were suggested. Research directions requiring more intense neutron sources were presented. Conclusions from the workshop are presented along with recommendations for future actions.

15092 (CONF-8410256—, pp 15-24) **Small-angle scattering.** Koehler, W.; Farnoux, B.; Glinka, C.; Schneider, D.; Seeger, P.; Worcester, D.; Wright, A. (Oak Ridge National Lab., TN). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Small-angle neutron scattering (SANS) instrumentation for both pulsed and steady state pulses are discussed. Cold neutrons and very low Q values are required to obtain the desired scattering vectors for proposed experiments. Other attributes required to meet suggested or potentially interesting experimental goals are: extended Q-range; improved resolution; polarization analysis; high flux for small, dilute, and thin samples, and real-time SANS.

15093 (CONF-8410256—, pp 25-44) **Collective excitations.** Windsor, C.; Buyers, B.; Cowley, R.; Robinson, R.; Shapiro, S. (AERE, Didcot, England). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Collective excitations continue as the area of greatest interest in condensed matter physics. It is necessary to have a triple axis spectrometer at a steady state source to best perform most experiments on collective excitations. For those experiments best done at a pulsed neutron source, a rotor time-of-flight spectrometer is requisite. Additionally, for a limited number of experiments requiring scattering over the entire Brillouin zone plane, chopper spectrometers are the instruments of choice. Relative merits and gains associated with improved sources and instrumentation are discussed.

15094 (CONF-8410256—, pp 45-63) **Crystallography (powder).** Jorgensen, J.D.; Cox, D.E.; Hewat, A.W.; Yelon, W.B. 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

The advent of the proposed intense neutron sources will allow the resolution from neutron powder diffractometers to reach that of x-ray diffractometers including ones at the synchrotron light sources. Over the next decade neutron powder diffraction will have significant impacts on several fields including: structure solution and refinement, time-resolved studies, small samples, and applied materials science - mechanical properties. New instruments will be needed to take advantage of the increased neutron flux. Three such instruments are proposed and operations on pulsed and steady state sources are compared.

15095 (CONF-8410256—, pp 64-82) **Crystallography (single crystal and protein).** Koetzle, T.F.; Schoenborn, B.P.; Arndt, U.W.; Blasie, J.K.; Jacobson, R.A.; Lehmann, M.S.; Mason, S.A.; Schultz, A.J. 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Medium and high-resolution single-crystal diffractometers are compared for use on pulsed and steady state neutron sources. It is shown that time-of-flight and steady-state diffractometers will have comparable performance. Time dependent experiments, such as polymerization studies and protein crystallography, are possible at the high flux facilities being proposed.

15096 (CONF-8410256—, pp 83-99) **Liquids and amorphous materials.** Copley, J.; Glaeser, W.; Howells, S.; Price, D.; Rhyne, J.; Skoeld, K.; Wagner, C. (McMaster Univ., Hamilton, Ontario). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Experiments on liquids and amorphous materials requiring the proposed high flux steady state and pulsed neutron sources are identified. Three areas of particular interest are multicomponent glasses and liquids, amorphous magnetic materials, and liquid helium-3. Instrumentation required to perform the indicated experiments is described.

15097 (CONF-8410256—, pp 100-117) **Polarized neutrons and their applications.** Moon, R.; Endoh, Y.; Felcher, G.; Majkrzak, C.; Mezei, F.; Pynn, R.; Shirane, G. (Oak Ridge National Lab., TN). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Neutron polarization provides additional information in scattering experiments. To achieve better utilization of this potential information, significantly higher neutron fluxes are required. Spin studies on magnetic materials cover: magnetic structure, spin density, and nuclear magnetism; spin dynamics, low dimensional magnets; disordered magnetic systems; surface and interface magnetism; and domain topography and depolarization studies. Studies on nonmagnetic materials and in nuclear physics include: separation of coherent and nuclear spin incoherent scattering to elucidate diffusion in liquids and solids; determination of correlations in macromolecular systems; measurement of the neutron dipole moment; and determination of the details of the weak interaction.

15098 (CONF-8410256—, pp 118-135) **High resolution spectroscopy.** Hayter, J.; Bauer, G.; Carlile, C.; Han, C.; Heidemann, T.; Richter, D.; Rowe, M.; White, J. (Oak Ridge National Lab., TN). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

High resolution, $\Delta E \leqq 50$ μeV, neutron spectroscopy requires an intense source of cold neutrons. Potential benefits of the proposed steady state and pulsed neutron sources are analyzed. Studies using high resolution spectroscopy come from diverse fields including: polymers and polyelectrolytes, condensed matter physics, chemical spectroscopy, colloidal systems, and biological systems. Gains to be achieved from development or fundamental redesign of time-of-flight, spin echo, and backscattering instrumentation are discussed.

15099 (CONF-8410256—, pp 136-153) **Chemical spectroscopy.** Eckert, J.; Brun, T.O.; Dianoux, A.J.; Howard, J.; Rush, J.J.; White, J.W. (Los Alamos National Lab., NM). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Chemical neutron spectroscopy utilizes the dependence of the scattering cross sections on isotopes and momentum transfer to elucidate the dynamics of molecules and fluids. Improvements in instrumentation coupled with the advent of the advanced neutron sources would have significant impacts on vibrational spectroscopy: high energy resolution studies including Q-dependent, medium resolution studies (differential spectroscopy and time-dependent processes), low energy spectroscopy (high energy resolution studies, high sensitivity studies, and polarization analysis), and high sensitivity studies.

15100 (CONF-8410256—, pp 154-169) **High energy excitations.** Brugger, R.; Carpenter, J.; Loewenhaupt, M.; Silver, R.; Taylor, A.; Watanabe, N. (Univ. of Missouri, Columbia). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

High energy (> 100 meV) excitations by neutron scattering are possible using the advanced neutron sources. A performance comparison is made of steady state and pulsed sources. Potential areas of investigation include magnetic excitations, momentum distributions, vibrational spectroscopy including local modes of light atoms in solids, liquids and amorphous materials, and neutron induced excitation detection (NIED). Instrumentation appropriate to high energy excitation studies is described.

15101 (CONF-8410256—, pp 170-186) **Fundamental neutron physics.** Deslattes, R.; Dombeck, T.; Greene, G.; Ramsey, N.; Rauch, H.; Werner, S. (National Bureau of Standards, Gaithersburg, MD). 1984. NTIS, PC A10/MF A01. File Number DE85012113.

From Workshop on scientific opportunities with advanced facilities for neutron scattering; Shelter Island, NY, USA (23 Oct 1984).

Fundamental physics experiments of merit can be conducted at the proposed intense neutron sources. Areas of interest include: neutron particle properties, neutron wave properties, and fundamental physics utilizing reactor produced γ-rays. Such experiments require intense, full-time utilization of a beam station for periods ranging from several months to a year or more.

15102 **(EIR—560) Application of Doppler broadening and integration of non resolved resonances in the code ETOBOX.** Paratte, J.M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jun 1985. 38p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780502.

In the library code ETOBOX the statistical parameters describing the unresolved resonances are integrated into group cross sections. The self-shielding is taken into account by means of a spectrum defined according to the narrow resonance approximation. The Doppler broadening is applied by means of the psi and chi functions. The mathematical model for the integration over the spectrum and the distribution functions is presented. The quality of the numerical applications in ETOBOX is demonstrated by comparing with precise calculations. Finally, the model is applied to both isotopes ^{235}U and ^{238}U. The results are group cross sections in infinite dilution, and the corresponding self-shielding factors for 3 values of the temperature (20, 450, and 1100°C) and for 3 equivalent cross sections (10, 100, and 1000 barn).

15103 (INIS-SU—392, pp 577) **Development of electromagnetic shower in silicon crystal.** Nadzhafov, I.M.; Mirantsev, L.V.; Radzhabov, M.R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15104 **(PB—87-103305/XAB) Transport of electrons and associated bremsstralung through a composite aluminum-lead shield, with applications to spacecraft shielding.** Barnea, G.; Seltzer, S.M.; Berger, M.J. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Jul 1986. 28p. (NBSIR—86/3429). NTIS, PC A03/MF A01.

Monte Carlo calculations have been made of the stopping of electrons and the penetration of secondary bremsstrahlung through layered aluminum-lead spacecraft walls. The results are presented in terms of the resultant radiation dose to objects inside. Dose values for monoenergetic incident electrons are given as a function of the aluminum/lead thickness ratio. These data, integrated over a few typical earth-orbit electron spectra, demonstrate the substantial reduction in radiation dose that can be achieved by replacing a portion of an aluminum shield with an inner layer of lead. The main results were obtained by applying a complex-geometry code to spherical-shell configurations. It was found that these results could be reasonably well approximated by an alternative and more economical approach, involving the use of slab-geometry transport results.

15105 **(PB—87-115531/XAB) Multidimensional radiation transport calculations. Final report.** Dunn, W.L. (Applied Research Associates, Inc., Raleigh, NC (USA)). Jul 1984. 59p. NTIS, PC A04/MF A01.

The back-projection angular-flux estimator employs a limiting process before the simulation, obviating the need to find average-flux values over finite spatial and angular intervals. The analysis was used to develop certain surface angular-flux estimators for the searchlight problem, with normal incidence and under some restrictions on azimuthal symmetry. The ability to estimate angular flux at a point is useful in radiation-transport calculations. It is hoped that the restriction to azimuthally symmetric situations can be relaxed in future work. It is noted that use of the back-project estimator makes possible certain analytic results without the need to perform any simulations.

15106 **Normalization of diffraction from porous non-crystalline systems.** Mildner, D.F.R.; Carpenter, J.M. (Univ. of Missouri, Columbia). *Journal of Non-Crystalline Solids;* **69**: 27-37(1984).

The usual method of normalizing diffraction data from non-crystalline systems is based on the exclusion of atoms from the immediate neighborhood of another atom. This procedure relates the structure-independent intensity to the average atomic density. Porous materials exhibit intense small angle scattering. If this scattering is ignored or removed from the data, the normalization is related to the local atom density; if the small angle data are included in the transform, the normalization is related to the bulk density. An incorrect normalization of the experimental data will produce errors in the correlation function and the measured coordination numbers. 12 references, 5 figures.

6550 Medical Physics

15107 **(BNL—38868) Use of a high repetition rate neutron generator for in vivo body composition measurements via neutron inelastic scattering.** Kehayias, J.J.; Ellis, K.J.; Cohn, S.H.; Weinlein, J.H. (Brookhaven National Lab., Upton, NY (USA); Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC02-76CH00016. 13p. (CONF-861114—35). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003481.

From 9. international conference on application of accelerators in research and industry; Denton, TX, USA (10 Nov 1986).

A small D-T neutron generator with a high pulse rate is used for the in vivo measurement of body carbon, oxygen and hydrogen. The core of the neutron generator is a 13 cm-long Zetatron tube pulsed at a rate of 10 kHz delivering 10^3 to 10^4 neutrons per pulse. A target-current feedback system regulates the source of the accelerator to assure constant neutron output. Carbon is measured by detecting the 4.44 MeV γ-rays from inelastic scattering. The short half-life of the 4.44 MeV state of carbon requires detection of the γ-rays during the 10 μs neutron pulse. Generators with low pulsing rate were found inappropriate for carbon measurements because of their low duty-cycle (high neutron output during the pulse). In vivo measurements were performed with normal volunteers using a scanning bed facility for a dose less than 25 mrem. This technique offers medical as well as general bulk analysis applications. 8 refs., 5 figs.

15108 (INIS-mf—10100, pp 29) **Beta-dose calculations using Monte Carlo technique.** Peto, A. (Magyar Tudomanyos Akademia, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

15109 (INIS-mf—10100, pp 39) **Computer analysis of complex thermoluminescence glow curves.** Peto, A.; Benko, L. (Magyar Tudomanyos Akademia, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

15110 (INIS-mf—10100, pp 44) **On-line glow curve recording with a computerized TLD system.** Szabo, P.P. (Hungarian Academy of Sciences, Budapest). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

15111 (INIS-mf—10100, pp 45) **Computer aided method for discriminating beta and gamma doses in a thick thermoluminescent dosimeter.** Rossbander, W.R.; Sahre, P. (Zentralinstitut fuer Nukleaforschung, Rossendorf, Germany). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

15112 (INIS-mf—10100, pp 40) **Effect of mathematical evaluation methods of thermoluminescence glow curves on the measured dose.** Ranogajec-Komor, M.; Vekic, B.; Dvornik, I.; Miklavzic, U.; Drazic, G.; Mihelic, M. (Institut Rudjer Boskovic, Zagreb, Yugoslavia; Institut Jozef Stefan, Ljubljana, Yugoslavia). Oct 1985. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780531. (CONF-851056—Absts.).

From Computer aided methods in radiation protection; Budapest, Hungary (22 Oct 1985).

15113 (INIS-SU—392, pp 560) **Optimization of neutron beams for medical and biological investigations.** Borisov, G.I.; Komkov, M.M.; Leonov, V.F. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15114 (INIS-SU—392, pp 564) **Gamma sources for calibration of medical radiodiagnostic devices.** Aristov, E.A.; Bakhshi-Zade, V.A.; D'yachkova, V.G.; Sichkar', G.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 13791, 13834, 13842, 13843, 14169, 14850, 15152

15115 **(BNL—38690) Phase transitions and metastable states in the presence of random fields.** Cowley, R.A.; Birgeneau, R.J.; Shirane, G. (Brookhaven National Lab., Upton, NY (USA); Edinburgh Univ. (UK). Dept. of Physics; Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 1986. Contract AC02-76CH00016. 14p. (CONF-860867—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87001471.

From International conference on statistical physics; Boston, MA, USA (11 Aug 1986).

The application of a uniform magnetic field to a diluted Ising antiferromagnet produces a random staggered field and so can be used to study the random field Ising model. This paper describes neutron scattering measurements on Mn/sub x/Zn/sub 1-x/F_2. They show that at low temperatures there are many metastable states which are all stable for experimentally accessible times. There is a sharp boundary in the H/T plane which separates metastability from ergodicity. The critical phenomena close to this metastability boundary is discussed. 12 refs., 4 figs.

15116 **(BNL—39075) Structure studies of thin amorphous films by synchrotron x-ray absorption and analytical electron microscopy.** Heald, S.M.; Tafto, J. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016;AS05-80ER10742. 6p. (CONF-861207—24). NTIS, PC A02. File Number DE87004181.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

We combine the techniques of EXAFS and XANES using synchrotron x-rays, and the corresponding techniques using electron energy loss spectroscopy (EXELFS and ELNES) to characterize and study the local atomic arrangement in thin amorphous films. These probes are complementary in that x-rays are best suited for absorption edges above 3 keV and electron energy loss spectroscopy for low energy edges, and thus this combination is very useful for amorphous materials containing both low and high Z elements. We use in addition transmission electron microscopy, electron diffraction, and electron energy loss spectroscopy in the low energy loss region. Results from amorphous TiO_2 and amorphous SnO_2 made by reactive sputtering are presented. 6 refs., 7 figs.

15117 **(DOE/ER/45134—3) Electron hybridization effects and the crystal structure of plutonium: February 8, 1986-December 29, 1986.** Cooper, B.R. (West Virginia Univ., Morgantown (USA). Dept. of Physics). 29 Dec 1986. Contract FG05-84ER45134. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004409.

Results are summarized for two areas of research. The research areas are: (1) Synthesis of Band and Model Hamiltonian Theory for Plutonium Systems and; (2) Resonant Band-f Scattering Theory for the Magnetic Properties of Highly Correlated Plutonium systems. (WRF)

15118 **(DOE/ER/45238—T1) [Properties of molecular solids and fluids at high pressure and temperature: Progress report].** Etters, R.D. (Colorado State Univ., Fort Collins (USA). Dept. of Physics). 1986. Contract FG02-86ER45238. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87004083.

The objective is to determine the equilibrium structures and orientations, lattice vibrational and librational mode frequencies, intramolecular vibron mode frequencies, sound velocities, equations of state, compressibilities, and structural and orientational phase transitions in molecular solids over a wide range of pressures and temperatures. In the high temperature fluid phase the equations of state, vibron frequencies, and melting transition, specific heats, compressibilities, second virial coefficients, viscosities and other transport properties, and the nature of orientational and magnetic correlations will be determined. The techniques used include several strategies to optimize multi-dimensional function as a means to determine equilibrium structures and orientations, self-consistent phonon lattice dynamics methods, constant pressure and constant volume Monte-Carlo strategies with continuously deformable boundary conditions, mean field approximations, and classical perturbation methods. Systems to be studied include H_2, N_2, O_2, CO, CO_2, F_2, N_2O, benzine, HCL, HBr, and Cl_2. 40 refs.

15119 (INIS-SU—392, pp 570) **Positron annihilation method for study of structural changes in KCl crystals stimulated by proton irradiation.** Bondarenko, A.L.; Aref'ev, K.P.; Boev, O.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15120 (INIS-SU—392, pp 578) **MgF/sub 2/(/sup 57/Co) crystal emission Moessbauer spectra (EMS).** Yuldashev, U.Yu.; Metsdorf, V.R.; Cherepanov, V.M.; Bogdanov, R.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15121 (INIS-SU—392, pp 556) **Positron annihilation in tantalum and niobium carbides.** Repin, I.A.; Svirida, S.V.; Semenikhin, A.N.; Gavrish, A.A.; Spasskij, M.R. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15122 (INIS-SU—392, pp 571) **Positron annihilation in HgTe and Hgsub(1-x)Cdsub(x)Te crystals irradiated by electrons and doped with Ag.** Babadzhanov, R.D.; Kakhonenko, A.K.; Pogrebnyak, A.D.; Ruzimov, Sh.M. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15123 (INIS-SU—392, pp 572) **Braking energy losses for neon ions in silicon.** Mitrokhin, O.E.; Strizhak, V.I.; Usikov, Yu.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15124 (INIS-SU—392, pp 575) **Seeming inhibition of positronium states in defect crystals.** Aref'ev, K.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15125 (INIS-SU—392, pp 552) **Use of NGR spectroscopy for radiation-induced defect study under irradiation of Nb/sub 3/Sn by 100 and 150 keV B/sup +/,P/sup +/ and Al/sup +/ ions.** Babikova, Yu.F.; Evstyukhina, I.A.; Devyatko, Yu.N.; Glazova, M.B. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15126 (INIS-SU—392, pp 554) **Positron tunneling into surface states in ultradispersed nickel particles.** Repin, A.I.; Svirida, S.V.; Girka, A.I.; Vlasov, P.V.; Novikov, V.I. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15127 (INIS-SU—392, pp 558) **Positron annihilation in CaF/sub 2/ monocrystals.** Georgiev, A.K.; Georgieva, M.K.; Mishev, P.L.; Tumbev, G.Kh. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15128 (LA-UR—86-4319) **Acoustic velocity measurements on fluid metals from two-fold compressions to two-fold expansions.** Shaner, J.W.; Hixson, R.S.; Winkler, M.A.; Brown, J.M. (Los Alamos National Lab., NM (USA); Washington Univ., Seattle (USA)). 1986. Contract W-7405-ENG-36. 13p. (CONF-860864—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003748.

From Meeting on strongly coupled plasma physics; Santa Cruz, CA, USA (4 Aug 1986).

Methods used for making acoustic velocity measurements on samples which are destroyed in time scales of milliseconds or less are described. Analytic techniques for using this data to calculate thermodynamic quantities are outlined. New results indicating a linear relationship of acoustic velocity with density over a very large density range are presented. 30 refs., 5 figs. (DWL)

15129 (LBL—22162) **Sintering theory for crystalline solids.** Searcy, A.W. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Nov 1986. Contract AC03-76SF00098. 24p. (CONF-860714—8). NTIS, PC A02/MF A01. File Number DE87004470.

From 22. University conference on ceramics - ceramic microstructures '86: role of interfaces; Berkeley, CA, USA (28 Jul 1986).

A thermodynamic model for vacancy partitioning among sites of different bonding environments, yields a more satisfactory expression for the driving forces for sintering and for grain growth at constant temperature than traditional theories. This expression is shown to be also a logical consequence of classical thermodynamic theory for faceted particles. Then the driving force for sintering in a temperature gradient is evaluated in terms of gradients in equilibrium vapor pressures. 26 refs., 6 figs.

15130 (LBL—22634) **Electronic Raman scattering in rare earth phosphate crystals.** Becker, P.C. (California Univ., Berkeley (USA)). Nov 1986. Contract AC03-76SF00098. 292p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE87004598.

The organization of the thesis is as follows: 1. A core unit which reviews the optical properties of lanthanide ions (Chapter 1) and discusses the general properties and results of electronic and vibrational Raman scattering in lanthanide phosphate crystals (Chapters 2 and 3). 2. A description of the experimental electronic Raman spectra of $Tm^{3}+$, $Er^{3}+$, and $Ho^{3}+$ in pure and diluted phosphate hosts (Chapter 4), and a theoretical chapter that analyzes and interprets the results with respect to the intensities of the transitions (Chapter 5). 3. A description and discussion of the experimental resonant electronic Raman spectra of $Er^{3}+$ in pure and diluted erbium phosphate crystals (Chapter 6), and a calculation of the relative intensities of the transitions that highlights quantum mechanical interference between the nonresonant and resonant intensity channels (Chapter 7). 4. A description and analysis of the coupled mode spectra of ytterbium phosphate crystals in the 300 cm^{-1} region in E/sub g/ symmetry (Chapter 8). 228 refs., 55 figs., 32 tabs.

15131 (SAND—86-1685C) **Dynamics of rapid solidification in silicon.** Peercy, P.S.; Thompson, M.O.; Tsao, J.Y. (Sandia National Labs., Albuquerque, NM (USA); Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science). Dec 1986. Contract AC04-76DP00789. 16p. (CONF-861207—23). NTIS, PC 02. File Number DE87004245.

From Materials Research Society fall meeting; Boston, MA, USA (1 Dec 1986).

Real-time techniques were used to study rapid melt and solidification dynamics in silicon. In crystalline Si, the interface response function was characterized and found to be asymmetric for large deviations from the melting temperature, which will require reevaluation of conventional transition state treatements of melt and solidification. In amorphous Si, the mechanism of explosive crystallization was studied. The explosive transformation is mediated by a buried liquid layer, and detailed measurements have led to the suggestion that polycrystalline Si nucleates at the moving liquid-amorphous interface. For certain conditions, this process could yield fine-grained polycrystalline SAi; for other conditions it permits epitaxial regrowth from the underlying crystalline Si for maximum melt thickness much less than the original amorphous layer thickness. 39 refs., 8 figs.

15132 (SAND—86-2494C) **Adsorbate interactions and poisoning on Cr(110).** Shinn, N.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1986. Contract AC04-76DP00789. 6p. (CONF-870224—1). NTIS, PC A02/MF A01. File Number DE87001739.

From 2. topical meeting on microphysics of surfaces, beams and adsorbates; Santa Fe, NM, USA (16 Feb 1987).

Spectroscopic studies of carbon monoxide and oxygen chemisorption on Cr(110) below 150K have revealed direct quantita-

tive evidence of co-adsorbate interactions which affect molecular dissociation pathways.

15133 **Equilibrium ring formation in polymer solutions.** Sponge, J.L. (Los Alamos National Lab., Los Alamos, NM). *Journal of Statistical Physics;* **43**: No. 1/2, 143-196(Apr 1986).

This paper delivers a flexible formalism for handling equilibrium ring formation. Based on graphical models of polymerization, it includes as special cases the Flory-Stockmayer RA/sub f/model, the Flory A/sub f/ RB/sub g/ model, and Gordon's branching process formalism. When simple ring formation occurs in equireactive systems, it also includes the Jacobson-Stockmayer RA_3 and Hoeve RA/sub f/ models. The formalism is built from first principles in statistical mechanics and all assumptions are clearly stated. All parameters are given in terms of thermodynamic variables. With ring weights generalizing the Jacobson-Stockmayer Gaussian random walk, the formalism yields results for branching RA/sub f/, A/sub f/RB/sub g/, and RA/sub f/-RB/sub g/ polymer models. Equireactivity then gives explicit solutions. The equireactive RA/sub f/-RB/sub g/ model compares favorably with data from gel-point vs. dilution experiments. With the exception of the Spanning Tree Approximation, graphical models of polymerization suffer from combinations of the following defects: equireactivity assumptions, restrictions to one type of monomer or bond, absence of rings, or absence of fused rings. This paper provides a promising "exact" approach to handling all of these problems simultaneously.

15134 **Bound eigenstates for some modified Coulomb pseudopotentials.** Kinser, H.B.; Crawford, O.H. (Dalton Junior College, GA). *Georgia Journal of Science;* **44**: No. 1-2, 37(1986).

From 63. annual meeting of the Georgia Academy of Science; Milledgeville, GA, USA (2-3 May 1986).

The Coulomb potential, modified to have a flat square-well-type bottom up to a critical distance from the center, has been helpful in the study of the solvated electron, atomic and molecular Rydberg states, and the electronic structure of the solid state. They report the investigation of the bound state eigenvalues and eigenfunctions for some of the modified coulomb pseudopotentials by the numerical solution of the one-dimensional radial differential equations involved. These calculations give quite close agreement with other calculations using approximate methods of solution and have allowed us to study other higher energy states for these potentials.

15135 **Characterization of surface defect structure by low energy electron diffraction.** Wendelken, J.F.; Wang, G.C.; Pimbley, J.M.; Lu, T.M. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **41**: 171-177(1985). Contract AC05-84OR21400.

Low energy electron diffraction is a surface sensitive tool which is most widely used for the determination of surface symmetries and equilibrium atomic positions. Experimental and theoretical advances made in the past five years make it possible now to use LEED also for the characterization of a wide variety of surface defect structures. In this paper a variety of experimental results involving analysis of diffracted electron beam shapes as a function of primary electron beam energy, adsorbate coverage, crystal temperature and ordering time are presented. These experimental results coupled with kinematic theory, allow the determination of step density, size and shape of reconstruction domains and overlayer islands, island size distribution in an overlayer during growth, and the mode of growth. 27 references, 4 figures.

15136 **Comparison of performance of an analytical electron microscope at 300 and 100 kV.** Bentley, J.; Kenik, E.A.; Angelini, P.; Fisher, A.T.; Sklad, P.S.; Lehman, G.L.; Horton, J.A. Jr. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **41**: 363-368(1985). Contract AC05-84OR21400.

Preliminary results on the performance of an analytical electron microscope (AEM) operating at 300 kV have been obtained and compared with the performance at 100 kV. Some features of the anticipated improvements for transmission electron microscopy (TEM) imaging, convergent beam electron diffraction (CBED), energy dispersive X-ray spectroscopy (EDS), and electron energy loss spectroscopy (EELS) have been studied from the aspect of materials science applications. The electron microscope used was a Philips EM430T operated with a LaB_6 cathode and equipped with EDAX 9100/90 EDS and Gatan 607 EELS systems. 12 references, 9 figures.

6561 Superconductivity

REFER ALSO TO CITATION(S) 13759, 13784

15137 **(BNL—38924) Basic ideas in the theory of organic conductors.** Emery, V.J. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 19p. (CONF-8608146—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003209.

From Low-dimensional conductors and superconductors; Quebec, Canada (24 Aug 1986).

From a theoretical point of view, the central goals are to understand how the organic superconductors managed to avoid a Peierls transition, and to unravel the fundamental mechanism of superconductivity, the source of the pairing interaction between charge carriers. The aim of these lectures is to address these questions in a general way, after giving an elementary survey of the basic physics of organic conductors.

15138 **(LBL—22185) Field effect and Josephson junction.** Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA)). Sep 1986. Contract AC03-76SF00098. 7p. (CONF-860914—29). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004473.

From Applied superconductivity conference (ASC '86); Baltimore, MD, USA (28 Sep 1986).

The value of the Josephson current in an S-M-S system, where M contains low-dimensional electron gas, can be affected noticeably by an applied voltage (field effect). This effect is directly related to the possibility of building a three-terminal device. The dependence of the current on the carrier concentration is studied. The peculiar situation when the state of lowest subband is described by the "dirty" limit whereas the higher subband represent the "clean" limit appears to be realistic. Inter-subband scattering results in a non-monotonic behavior of the current.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 13868, 13950, 14172, 14512, 14651, 14652, 14665, 14675

15139 **(DOE/ER/10979—13) Nonlinear optics with broad-band lasers: Progress report for period July 15, 1986-July 1987.** Raymer, M.G. (Rochester Univ., NY (USA). Inst. of Optics). Jan 1987. Contract AC02-81ER10979. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004306.

During this reporting period a number of significant results were obtained and new investigations were established. The studies of the fluctuation dynamics of pulsed dye lasers and of stimulated Raman scattering (SRS) were completed. The main results obtained in this work are: (a) mode intensities and phases were found to be correlated in a pulsed dye laser; (b) conditions were found under which the dye laser produced FM-locked output; (c) a method was found for smoothing the temporal shape of the dye laser pulses; (d) Stokes intensity autocorrelation and laser-Stokes cross-correlation measurements showed that the development of correlations between the pump laser light and Stokes light generated by SRS depends on the relationship between two time scales - that of the laser fluctuations and that of the molecular Raman response. A new multifaceted program has been established to study the statistical aspects of broadband continuous-wave dye lasers that are relevant to better understanding intracavity laser spectroscopy (ILS). The central, still unanswered, question in this field is: what mechanisms limit the mode lifetimes and thereby limit the present and ultimately achievable sensitivity of ILS. Our goal is to eliminate all extrinsic mechanisms, leaving only those intrinsic to the laser-quantum noise and deterministic chaos. 12 refs., 10 figs.

15140 **(DOE/ER/13147—2-Pt.9) Perspectives on studies of chaos in experiments.** Swinney, H.L. (Texas Univ., Austin (USA). Dept. of Physics). 1985. Contract AS05-84ER13147. 3p. (CONF-8505207—2-Pt.9). NTIS, PC A02/MF A01. File Number DE87000765.

From Conference on perspectives in nonlinear dynamics; Washington, DC, USA (28 May 1985).

Noisy signals have traditionally been analyzed using Fourier spectra, correlation functions, and other methods developed for linear systems. However, these techniques are inadequate for characterizing chaos in deterministic nonlinear systems. More appropriate properties for characterizing chaos are the Lyapunov exponents, entropy, and dimension of the attractors. Methods are now being developed to compute these properties from time series data obtained in laboratory experiments. We briefly describe some of these methods and their limitations and applications. 26 refs.

15141 (INIS-SU—392, pp 192) **On differential methods of obtaining boson realizations of collective Hamiltonians.** Smirnov, Yu.F.; Tolstoj, V.N. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15142 (INIS-SU—392, pp 195) **Equations for the multiparticle wave functions components and their solutions.** Kamuntavichyus, G.P. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15143 (INIS-SU—392, pp 260) **To the problem on the invariance of the Hartree-Fock-Dirac method.** Listengarten, M.A. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15144 (INIS-SU—392, pp 408) **Limiting model-independent relationships between three-particle parameters.** Simenog, I.V.; Shapoval, D.V. 1986. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE87780053. (CONF-8604278—Summs.).

From 36. conference on nuclear spectroscopy and nuclear structure; Khar'kov, USSR (15 Apr 1986).

15145 (JINR—R-2-85-667, pp 119-126) **Experience in the compilations of a dictinary for specialists in gravitation.** Chernikov, N.A. 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

An attempt is made to share experience and to make feasible contribution to compiling a dictionary for gravity physicists. Such notions as group operating on set, group invariance, relativity principle, arithmetic space, affinity group operating on set, invariant metrics, Galileo group, Poincare group, Lorentz group, inertial system, Kotelnikov space and three canonical gravitational theories are interpreted.

15146 (JINR—R-2-85-667, pp 143-150) **Invariant energy characteristics of gravitational wave fields with a source.** Borisova, L.B. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Classification of gravitational fields is formulated in the language of physical observables representing chronometrically invariant values. The invariant approach to the problem of defining energy characteristics of a gravitational field with arbitrary matter distribution based on formal analogy with electromagnetism brings about results differing from those proceeding from the noninvariant approach.

15147 (JINR—R-2-85-667, pp 157-168) **Relative acceleration, acceleration of shift, rotation and expansion (compression) in (pseudo) Riemannian spaces with torsion and without torsion.** Manov, S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1985. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075. (CONF-8506332—).

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Expansion of the first and second covariant derivatives in the direction of nonisotropic vector field and their relation with notions of relative velocity and relative acceleration, rate and acceleration of shift, rotation, expansion (compression) in (pseudo)riemannian spaces with torsion and without torsion are considered. Expansion of Riemann tensor and Ricci tensor projections relatively to a nonisotropic vector field are found and their physical interpretation is discussed.

15148 **(JINR—R-2-85-667) Gravitation waves. Proceedings of the conference on design of gravitational wave radiator and detector.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1985. 173p. (In Russian). (CONF-8506332—). NTIS (US Sales Only), PC A08/MF A01. File Number DE87780075.

From Conference on the history of particle physics; Dubna, USSR (25 Jun 1985).

Separate abstracts were prepared for 20 papers in these conference proceedings. (DWL)

15149 **(LA-UR—86-3882) The gravitational properties of antimatter.** Goldman, T.; Hughes, R.J.; Nieto, M.M. (Los Alamos National Lab., NM (USA)). Sep 1986. Contract W-7405-ENG-36. 11p. (CONF-8609221—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003367.

From International school on low energy antiproton physics; Sicily, Italy (27 Sep 1986).

It is argued that a determination of the gravitational acceleration of antimatter towards the earth is capable of imposing powerful constraints on modern quantum gravity theories. Theoretical reasons to expect non-Newtonian non-Einsteinian effects of gravitational strength and experimental suggestions of such effects are reviewed. 41 refs. (LEW)

15150 **(LA-UR—86-4203) Symmetries of some hypergeometric series: Implications for 3j- and 6j-coefficients.** Louck, J.D.; Beyer, W.A.; Biedenharn, L.C.; Stein, P.R. (Los Alamos National Lab., NM (USA)). Oct 1986. Contract W-7405-ENG-36. 8p. (CONF-8610110—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE87003737.

From 15. international colloquium on group theoretical methods in physics; Philadelphia, PA, USA (20 Oct 1986).

The occurrence of generalized hypergeometric series as factors, in the Wigner-Clebsch-Gordan (3j) and Racah (6j) coefficients is well known. The recently discovered S_6 symmetry of the Saalschcutzian ${}_4F_3$ series may be used to extend the symmetries of the 6j-coefficients to the much larger group generated by S_6 and the group of Regge symmetries. (A similar extension may be carried out for the 3j-coefficients). The required extension of the domain of definition of the 6j-coefficients and the properties of its symmetry group is developed here. 7 refs.

15151 **(UCID—20932) Hydrodynamics of exploding foils: Progress on similarity solution and a stability analysis for early time.** Hunter, J.H. (Florida Univ., Gainesville (USA); Lawrence Livermore National Lab., CA (USA)). 25 Nov 1986. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01. File Number DE87005280.

This report addresses two broad aspects of the behaviors of hydrodynamic flows, resulting from laser heated, exploding foils. In Part I, various aspects of the similarity solutions are considered,

whereas in Part II the stability of the flows at early times are examined, before the similarity solutions are established. 5 refs., 3 figs.

15152 **(UCRL—95866) Shock wave interaction with turbulence: Pseudospectral simulations.** Buckingham, A.C. (Lawrence Livermore National Lab., CA (USA)). 30 Dec 1986. Contract W-7405-ENG-48. 9p. (CONF-8611115—3). NTIS, PC A02/MF A01. File Number DE87004357.

From Nuclear explosives code development conference; Albuquerque, NM, USA (17 Nov 1986).

Shock waves amplify pre-existing turbulence. Shock tube and shock wave boundary layer interaction experiments provide qualitative confirmation. However, shock pressure, temperature, and rapid transit complicate direct measurement. Computational simulations supplement the experimental data base and help isolate the mechanisms responsible. Simulations and experiments, particularly under reflected shock wave conditions, significantly influence material mixing. In these pseudospectral Navier-Stokes simulations the shock wave is treated as either a moving (tracked or fitted) domain boundary. The simulations assist development of code mix models. Shock Mach number and pre-existing turbulence intensity initially emerge as key parameters. 20 refs., 8 figs.

15153 **Monte Carlo physics on a concurrent processor.** Fox, G.C.; Otto, S.W.; Umland, E.A. (California Institute of Technology, Pasadena, CA). *Journal of Statistical Physics;* **43**: No. 5/6, 1209-1237(Jun 1986). (CONF-8509213—).

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

We show how Monte Carlo problems of various kinds can be efficiently implemented on a parallel processor possessing the interconnect topology of a hypercube. Examples discussed include lattice gauge theory, the physics of two dimensional melting, long-range interactions, and simulated annealing.

15154 **Proceedings of the conference on frontiers of Quantum Monte Carlo.** Gubernatis, J.E. *Journal of Statistical Physics;* **43**: No. 5/6, 731-1244(Jun 1986). (CONF-8509213—).

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

This journal of conference proceedings includes papers on topics such as: computers and science; Quantum Monte Carlo; condensed matter physics (with papers including the statistical error of Green's Function Monte Carlo, a study of Trotter-like approximations, simulations of the Hubbard model, and stochastic simulation of fermions); chemistry (including papers on quantum simulations of aqueous systems, fourier path integral methods, and a study of electron solvation in polar solvents using path integral calculations); atomic molecular and nuclear physics; high-energy physics, and advanced computer designs.

15155 **On the dielectric susceptibility of classical Coulomb systems.** Choguard, P.; Piller, B.; Rentsch, R. (Ecole Polytechnique Federale de Lausanne, Lausanne). *Journal of Statistical Physics;* **43**: No. 1/2, 197-105(Apr 1986).

This paper reports exact and numerical results on the shape dependence of the dielectric susceptibility of the one-component plasma (O.C.P.) in two dimensions. Some apparently conflicting predictions of phenomenological electrostatics and statistical mechanics are resolved. We prove indeed that, for a disk shaped two-dimensional one-component plasma at the particular temperature $T_0 = q^2(2K/\text{sub } B/)^{-1}$, the Clausius-Mossotti relation is exactly fulfilled. It yields a value of the susceptibility which is twice that given by the second moment Stillinger-Lovett sum rule. Similar results are reported for the strip geometry. These discrepancies are explained in terms of shape dependent versus shape independent thermodynamic limits. We report also exact and numerical results on the size dependence of the dielectric susceptibility of the systems quoted above.

15156 **Heat conductivity of three periodic hard disks via nonequilibrium molecular dynamics.** Hoover, W.G.; Kratky, K.W. (Univ. of Vienna, Vienna). *Journal of Statistical Physics;* **42**: No. 5-6, 1103-1114(Mar 1986).

The authors use a driving field, of the type first suggested by Evans, to generate a steady heat current in the simplest possible system, a two-dimensional periodic "fluid" of three hard disks. Hard-disk motion equations can be conveniently derived from repulsive constant-force or linear-force potentials by considering the infinitely repulsive limits of these potentials. The authors show that the isoenergetic and isokinetic forms of the nonequilibrium equations of motion generate steady-state heat conductivities differing in terms of order 1/N where N is the number of particles. The resulting conductivities appear to vary as the logarithm of the driving field strength. Even at low fields, the three-body periodic-system results lie well below Enskog's infinite-system prediction.

15157 **MOLAG: a method of lines adaptive grid interface for nonlinear partial differential equations.** Madsen, N.K. (Lawrence Livermore National Lab., CA). pp 207-223 of PDE SOFTWARE: modules, interfaces and systems. Engquist, B.; Smedsaas, T. (eds.). Amsterdam, Netherlands; Elsevier Science Publishers BV (1984). Contract W-7405-ENG-48.

The authors describe an adaptive grid or moving node method which can be used to solve systems of nonlinear partial differential equations. The method is implemented in the form of a method of lines software interface. When this interface is combined with a reliable ordinary differential equation solver, one obtains the capability to adaptively solve systems of partial differential equations. Numerical results are presented. 4 references.

15158 **Outlier.....s.** Beckman, R.J.; Cook, R.D. (Los Alamos National Labs., NM). *Technometrics;* **25**: No. 2, 119-149(May 1983).

The concern over outliers is old and undoubtedly dates back to the first attempt to base conclusions on a set of statistical data. Comments by Bernoulli (1777) indicate that the practice of discarding discordant observations was commonplace 200 years ago. The history of the treatment of such observations is traced from these early comments to the present. For simple normal samples, M estimators, L estimators, and Bayesian estimators are presented as techniques that accommodate outliers in estimation. For the study of concomitant variables, methods are given for the outright rejection of discordant observations. Rejection techniques for multiple outliers are reviewed, as are the effects of masking and swamping. Methods for the detection of outliers in a regression setting are given for various models. Influence functions in multiple regression are discussed and compared with both the classical and the Bayesian methods of outlier detection. Work on outliers in circular data, discriminant analysis, experimental design, multivariate data, generalized linear models, distributions other than normal, and time series is also reviewed. 229 references.

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15159 **(ANL/FPP—87-1) Technical planning activity: Final report.** (Argonne National Lab., IL (USA)). Jan 1987. Contract W-31-109-ENG-38. 382p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE87004635.

In April 1985, the US Department of Energy's (DOE's) Office of Fusion Energy commissioned the Technical Planning Activity (TPA). The purpose of this activity was to develop a technical planning methodology and prepare technical plans in support of the strategic and policy framework of the Magnetic Fusion Program Plan issued by DOE in February 1985. Although this report represents the views of only the US magnetic fusion community, it is international in scope in the sense that the technical plans contained herein describe the full scope of the tasks that are prerequisites for the commercialization of fusion energy. The TPA has developed a well-structured methodology that includes detailed definitions of technical issues, definitions of program areas and elements, statements of research and development objectives, identification of key decision points and milestones, and descriptions of facility requirements.

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REFER ALSO TO CITATION(S) 13990, 14171, 15216

15160 (AD-A—174357/4/XAB) Plasma theory and simulation. Quarterly progress report Nos. 1 and 2, 1 January-30 June 1985. Birdsall, C.K. (California Univ., Berkeley (USA). Electronics Research Lab.). Jun 1985. 38p. (N—00014-77-C-0578). NTIS, PC A03/MF A01.

Partial contents include: (1) The Alfven Ion Cyclotron Instability: Simulation Theory and Techniques; (2) Transport of particle and energy fluxes through the plasma-sheath region, including ion reflection. The time-independent theory developed is very nearly verified by the average of the time-dependent simulations, with some exceptions; (3) Thermionic emission I-V paradox. The problem is described (Longo's 1/J observations) and conjectures are offered on the causes; (4) POLY: A hybrid scheme for the solution of the Vlasov equation. One component is modeled by linearized fluid equations and the other component(s) by the full Vlasov equation(s).

15161 (CONF-8505100—19) Ion ring experiments with applications to the compact toroid program. Schamiloglu, E.; Greenly, J.B.; Hammer, D.A.; Pedrow, P.D.; Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). May 1985. Contract AC02-77ET53005. 11p. (LPS—343). NTIS, PC A02/MF A01. File Number DE87003366.

From 7. symposium on the physics and technology of compact toroids in the magnetic fusion energy program; Santa Fe, NM, USA (21 May 1985).

We report here the status of the ion ring experimental program at Cornell. Ion rings having 3 x 10^{18}. 430 keV protons have been trapped in the Ion Ring Experiment (IREX) in a 0.8 T magnetic field. Trapping was achieved using a static downstream mirror and a fast (1.7 μsec rise time) gated upstream mirror. Ring protons were detectable for up to 4 μsec (about 50 times both the ion cyclotron period and the injection pulse duration). On LONGSHOT II, up to 1 kJ of ≦ 150 keV ions has been produced in 0.4 to 0.9 μsec pulses using an active anode plasma source as well as the standard surface flashover source. The LONGSHOT II beam will shortly be formed into a rotating proton layer and injected into a preformed (0.3 m diameter and 2.5 m long) Z-discharge plasma to study axial energy dissipation processes. This proton layer ultimately is to be combined with a compact toroid plasma.

15162 (DOE/ET/53088—141) Linear and nonlinear description of drift instabilities in a high beta plasma. Aydemir, A.Y.; Berk, H.L.; Mirnov, V.; Pogutse, O.P.; Rosenbluth, M.N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1986. Contract FG05-80ET53088. 34p. (IFSR—141). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004482.

We derive a nonlinear system of equations for drift waves in a high beta plasma (β much greater than 1). The magnetic field pressure is taken small compared to the particle pressure. Pressure balance is established by having a uniform particle pressure with the density and temperature gradients in opposite directions. The primary purpose of the magnetic field is to inhibit radial heat flux. This is the principle of such plasma fusion systems as the wall sustained multiple mirror, compressed liner, and magnetic-insulated inertial fusion, where the heat is contained over a relatively short radial scale length and a long axial scale length. The nonlinear equations for the mathematical model contain drift instabilities which give rise to radial heat and particle fluxes that can enhance the losses expected from classical collisional effects. The linear and nonlinear evolution of the model is studied here.

15163 (DOE/ET/53088—243) Structural stability and chaotic solutions of perturbed Benjamin-Ono equations. Birnir, B.; Morrison, P.J. (California Univ., Santa Barbara (USA). Dept. of Mathematics; Iceland Univ., Reykjavik. Science Inst.; Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1986. Contract FG05-80ET53088;AS03-82ER12097. 42p. (IFSR—243). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004204.

A method for proving chaos in partial differential equations is discussed and applied to the Benjamin-Ono equation subject to perturbations. The perturbations are of two types: one that corresponds to viscous dissipation, the so-called Burger's term, and one that involves the Hilbert transform and has been used to model Landau damping. The method proves chaos in the PDE by proving temporal chaos in its pole solutions. The spatial structure of the pole solutions remains intact, but their positions are chaotic in time. Melnikov's method is invoked to show this temporal chaos. It is discovered that the pole behavior is very sensitive to the Burger's perturbation, but is quite insensitive to the perturbation involving the Hilbert transform.

15164 (DOE/ET/53088—263) Finite pressure ballooning mode stability in toroidal equilibria. Llobet, X.; Berk, H.L.; Rosenbluth, M.N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1986. Contract FG05-80ET53088. 32p. (IFSR—263). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004483.

We examine the effect of finite pressure on the ballooning instability in toroidal MHD equilibria of steep boundary stellarators and tokamaks. Ballooning modes tend to arise near the place where the local shear vanishes and the normal curvature (the curvature component perpendicular to the flux surface, pointing away from the magnetic axis) is negative. We will show how the pressure gradient determines the position of the shearless points, and demonstrate in detail how this effect explains the existence of second stability in tokamaks. For large aspect ratio circular cross-section tokamaks the second stability condition is found to scale as α = const S/sup 1.25/. Stellarators are inherently more stable, due to the negative vacuum shear which at moderate pressure gradients allows the zero shear point to localize on the inner side of the flux surface. However, at high pressure gradients the Pfirsch-Schlueter current produces a positive mean shear when the total toroidal current on a flux surface is zero. This causes the zero shear point to localize on the outer edge, near the vertical extremes of the flux surface. This causes the zero shear point to localize on the outer edge, near the vertical extremes of the flux surface. This effect, together with helical contributions to the helical curvature, allows for ballooning instability to arise. At higher pressure gradients, with zero net toroidal current, an unstable ballooning mode which localizes to within a helical period always arises where the normal curvature is unfavorable.

15165 (EGG-EP—7394) User's manual for DSTAR MOD1: A comprehensive tokamak disruption code. Merrill, B.J.; Jardin, S.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 14 Oct 1986. Contract AC07-76ID01570. 104p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87004544.

A computer code, DSTAR, has recently been developed to quantify the surface erosion and induced forces that can occur during major tokamak plasma disruptions. The DSTAR code development effort has been accomplished by coupling a recently developed free boundary tokamak plasma transport computational model with other models developed to predict impurity transport and radiation, and the electromagnetic and thermal dynamic response of vacuum vessel components. The combined model, DSTAR, is a unique tool for predicting the consequences of tokamak disruptions. This informal report discusses the sequence of events of a resistive disruption, models developed to predict plasma transport and electromagnetic field evolution, the growth of the stochastic region of the plasma, the transport and nonequilibrium ionization/emitted radiation of the ablated vacuum vessel material, the vacuum vessel thermal and magnetic response, and user input and code output.

15166 (GA-A—18630) Confinement in electron cyclotron heating experiments on Doublet III. Prater, R.; Ejima, S.; Harvey, R.W.; Lieber, A.J.; Matsuda, K.; Moeller, C.P. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1986. Contract AC03-84ER51044. 14p. (CONF-861106—15). NTIS, PC A02/MF A01. File Number DE87004404.

From IAEA international conference on plasma physics and controlled nuclear fusion research; Kyoto, Japan (12 Nov 1986).

Electron Cyclotron Heating experiments have been performed on the Doublet III tokamak in the expanded boundary divertor configuration. Effective ECH heating is found even at densities twice the cutoff density, with no decrease in the global energy confinement time when the cutoff is exceeded. Analysis of the behavior of the sawteeth and of the soft x-ray emission indicates that for the overdense discharges the ECH heating is taking place near the plasma edge. A simplified transport analysis indicates that the electron thermal transport coefficient decreases a factor 2 when the heating is centrally localized. The transport analysis is confirmed by the behavior of the propagation of the heat pulse when ECH is initiated. The edge heating results in a large improvement in energy confinement over the inner two thirds of the plasma.

15167 (ISAS-SP—4, pp vp) **Mathematical and computational models of plasma flows.** Brushlinsky, K.V. 1985. NTIS, PC A12/MF A01. (CONF-8511254—).

From Symposium on mechanics for space flight; Tokyo, Japan (7 Nov 1985).

Investigations of plasma flows are of interest, firstly, due to numerous applications, and secondly, because of their general principles, which form a special branch of physics: the plasma dynamics. Numerical simulation and computation, together with theoretical and experimental methods, play an important part in these investigations. Speaking on flows, a relatively dense plasma is mentioned, so its mathematical models appertain to fluid mechanics, i.e., they are based on the magnetohydrodynamic description of plasma. Time dependent two dimensional models of plasma flows of two wide-spread types are considered: the flows across the magnetic field and those in the magnetic field plane.

15168 (LA—10839-MS) **A study of the propagation of ulf electromagnetic fields in collisional, inhomogeneous, magnetized plasmas.** Borovsky, J.E. (Los Alamos National Lab., NM (USA)). Feb 1987. Contract W-7405-ENG-36. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87004768.

The propagation of ultralow-frequency (ulf) electromagnetic signals (Alfven and magnetosonic waves) in collisional, inhomogeneous, magnetized plasmas is analyzed by numerical simulation. The problem is formulated from a Maxwell-equation orbit-theory approach rather than from a magnetohydrodynamic point of view, and the problem is numerically treated in a fully time-dependent manner. Boundary-value-problem behavior is distinguished from initial-value-problem behavior. The propagation of two-dimensional small-amplitude electromagnetic disturbances in plasmas with spatially dependent densities and in plasmas with spatially dependent conductivities is numerically simulated, and when possible, the simulations are compared with theory. Changes in the plasma density lead to changes in the signal speed and to reflections; collisions lead to changes in the signal speed, to reflections, and to attenuations. Theoretical descriptions based upon discontinuities in the media are generally incorrect in predicting the amplitudes of signals reflected from plasma inhomogeneities. 19 refs., 16 figs.

15169 (LBL—22386) **Proposed neutral-beam diagnostics for fast confined alpha particles in a burning plasma.** Schlachter, A.S.; Cooper, W.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1986. Contract AC03-76SF00098. 14p. (CONF-8610115—14). NTIS, PC A02/MF A01. File Number DE87003536.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

Diagnostic methods for fast confined alpha particles are essential for a burning plasma experiment. Several methods which use energetic neutral beams have been proposed. We review these methods and discuss system considerations for their implementation.

15170 (ORNL/TM—10200) **Effects of isotropic alpha populations on tokamak ballooning stability.** Spong, D.A.; Sigmar, D.J.; Tsang, K.T.; Ramos, J.J.; Hastings, D.E.; Cooper, W.A. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87005273.

Fusion product alpha populations can significantly influence tokamak stability due to coupling between the trapped alpha precessional drift and the kinetic ballooning mode frequency. Careful, quantitative evaluations of these effects are necessary in burning plasma devices such as the Tokamak Fusion Test Reactor and the Joint European Torus, and we have continued systematic development of such a kinetic stability model. In this model we have considered a range of different forms for the alpha distribution function and the tokamak equilibrium. Both Maxwellian and slowing-down models have been used for the alpha energy dependence while deeply trapped and, more recently, isotropic pitch angle dependences have been examined.

15171 (SAIC—86/1120-PRI-102) **Microwave heating and cyclotron instability of hot electron plasmas.** Hafizi, B.; Aamodt, R.E. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Nov 1986. 61p. NTIS, PC A04/MF A01. File Number DE87004780.

A relativistic theory of electron heating to high energies by narrow-band microwaves directed into a spatially limited region of plasma is formulated. A novel feature of the analysis is its prediction regarding the motion of electrons along field lines. Specifically, the phase space of trapped electrons is found to be divided into two parts. In one, as an electron gains energy its turning point moves towards the region of weaker magnetic field; in the other, energy gain results in the turning point moving towards the region of strong magnetic field, with possible detrapping. For field amplitudes well above the threshold for intrinsic stochasticity in the coherent microwaves, a Fokker-Planck equation for the particle distribution is derived, and the steady-state solution for energetic particles reduced to quadrature. Electron cyclotron instabilities, brought about by the energetic population, induce diffusion of electrons and tend to deform the microwave-generated distribution. The distribution function under the joint action of heating and instability is derived. Superadiabaticity of particle motion is discussed. The dispersion relation for the cyclotron waves provides a relationship between the energy density in the microwaves and that in the saturated state of the cyclotron fluctuations.

15172 (UCRL—95799) **Neutral-beam current drive in tokamaks.** Devoto, R.S. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 11p. (CONF-8610115—12). NTIS, PC A02/MF A01. File Number DE87003467.

From 4. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (27 Oct 1986).

The theory of neutral-beam current drive in tokamaks is reviewed. Experiments are discussed where neutral beams have been used to drive current directly and also indirectly through neoclassical effects. Application of the theory to an experimental test reactor is described. It is shown that neutral beams formed from negative ions accelerated to 500 to 700 keV are needed for this device.

15173 **High energy X-ray measurements during lower hybrid current drive on the Alcator C tokamak.** Texter, S.; Knowlton, S.; Porkolab, M.; Takase, Y. (Massachusetts Inst. of Tech., Cambridge, USA. Plasma Fusion Center). *Nuclear Fusion;* **26**: No. 10, 1279-1291(Oct 1986).

High energy X-ray emission (Esub(γ)>20 keV) from superthermal plasma electrons during lower hybrid current drive on the Alcator C tokamak has been measured using sodium iodide (NaI) scintillation spectroscopy. The X-ray spectra are generally linear on a semi-log plot of count rate versus photon energy and extend out to several hundred kiloeletronvolts. For the range of densities (n-barsub(e)approx.=(0.3-0.8) x 10/sup 14/cm/sup -3/) over which current drive was performed on Alcator, there was negligible emission before the injection of radio-frequency wave power. The radial profiles of the emission were also measured and indicate that the current carrying high energy electrons exist primarily within the inner half (r/a<1/2) of the plasma column. Plasma parameter scans produced variations in the X-ray emission profiles that are consistent with changes in the launched Fourier power spectrum and the conditions imposed by lower hybrid wave accessibility. In addition, the velocity space distribution function of the energetic tail electrons has been determined using the angular variation in the X-ray emission. 16 refs, 11 figs.

15174 **Plasma confinement in toroidal discharges sustained by a highly conducting plasma current.** Chu, T.K.; Bell, R.; Cavallo, A.; Colestock, P.; Stevens, J.; Strachan, J.; Goeler, S. von; Wilson, R. (Princeton Univ., NJ, USA. Plasma Physics Lab.). *Nuclear Fusion;* **26**: No. 10, 1319-1323(Oct 1986).

Experiments in inductively driven discharges in the PLT tokamak show an order of magnitude decrease of the electrical resistivity from the Spitzer-Haerm value as the density is lowered from 1.5 x 10/sup 13/cm/sup -3/ to 8 x 10/sup 11/cm/sup -3/, indicating a corresponding decrease of electron cross-field thermal conductivity as the principal current carriers change from thermal electrons to runaway electrons. The results suggest that electron thermal conductivity in discharges with Spitzer-Haerm resistivity may be reduced by increasing the fraction of current carried by runaway electrons with the aid of radiofrequency waves or other means. 15 refs, 1 fig.

15175 **Evaluation of toroidal energy density in beam-heated ISX-B plasmas.** Lazarus, E.A.; Wieland, R.M.; Neilson, G.H.; Sigmar, D.J.; Hirshman, S.P.; Bell, J.D. (Oak Ridge National Lab., TN, USA). *Nuclear Fusion;* **26**: No. 10, 1349-1358(Oct 1986).

In some neutral-beam-heated ISX-B plasmas, the Thomson scattering profiles show that surfaces of constant temperature and surfaces of constant density do not coincide. This discrepancy is analysed in terms of the modification of the plasma equilibrium arising from toroidal rotation or other enhancements of the toroidal component of the stored energy density. 15 refs, 8 figs, 2 tabs.

15176 **Expanded boundary reversed field pinch.** La Haye, R.J.; Moore, R.W. (GA Technologies, Inc., San Diego, CA, USA). *Nuclear Fusion;* **26**: No. 10, 1371-1376(Oct 1986).

Magnetohydrodynamic equilibrium calculations are presented for a reversed field pinch having a boundary consisting of a magnetic separatrix which leads down into an expansion chamber where the heat flux coming out of the hot core of the pinch could be more easily handled. High shear results near the separatrix. Letter-to-the-editor. 21 refs, 6 figs.

15177 **Numerical study of the effects of anisotropic pressure on ideal MHD equilibrium and stability in tokamaks.** Salberta, E.R. Princeton, NJ; Princeton Univ. (1986). 120p. University Microfilms Order No. 86-21,725.

Thesis (Ph. D.).

The use of neutral beam heating in tokamaks can produce equilibria with anisotropic pressure. Numeric representations of beam ion distribution functions generated by a multi group algorithm in a pre-existing code are used to obtain representative two dimensional beam pressure profiles. These profiles are used in a modified form of the PEST equilibrium code to generate Chew Goldberger Low equilibria corresponding to a wide range of beam injection angles. The stability of these equilibria to high n modes is analyzed with a modified code, using a form of the ballooning equation derived from the gyrokinetic equation. Finite ion Larmor radius stabilization effects are also considered. Finally, the necessary algebra toward implementation of the universal term of the anisotropic δW energy principle into a modified form of the PEST-2 low-n mode stability code is also presented.

15178 **Space and time resolved soft x-ray spectroscopy of high energy density plasmas.** Kiuttu, G.F. Albuquerque, NM; Univ. of New Mexico (1986). 139p. University Microfilms Order No. 86-20,989.

Thesis (Ph. D.).

For a success of experiments or applications involving plasmas, a knowledge of fundamental parameters such as temperature and density is often critical. Spectral radiation diagnostics can provide this information when interpreted with a suitable plasma model. Historically, for inertial confinement fusion, x-ray source, and other plasmas characterized by large temporal and spatial gradients, spectra have been recorded temporally and/or spatially integrated. This has led to large uncertainties in data interpretation. A technique is described here that yields two dimensional space-resolved soft x-ray spectra for intensity radiating extended sources. The technique uses the dispersive imaging properties of convex curved Bragg crystals. An analysis of the dispersions imaging is presented along with estimates of attainable resolution and aberration. An instrument was constructed using dispersion imaging, and two-dimensional soft x-ray spectra of high energy density aluminum plasmas were recorded time-integrated with photographic film.

15179 **Plasma simulation studies in the ion cyclotron frequency range: the Alfven ion-cyclotron instability and stabilizing effects of ICRF on the interchange mode.** Otani, N.F. Berkeley, CA; Univ. of California (1986). 237p. University Microfilms Order No. 86-24,886.

Thesis (Ph. D.).

A combination of computer simulation and theoretical techniques is employed in the study of two plasma effects: the Alfven ion-cyclotron (AIC) instability and the effect of finite-amplitude ICRF waves on the growth rate of the interchange instability. Simulation of the AIC instability is conducted with two simulation codes. Characteristics of the simulation algorithms are analyzed theoretically. Several features of the single-wave version of the AIC instability are extracted from invariants of the ion motion. In particular, the invariant associated with the helical symmetry of the AIC wave is found to confine classes of ion particles to two-dimensional surfaces in velocity space on which trapping is observed to occur. Multiwave simulations of the instability show evidence of both ion trapping and quasilinear diffusion. Short-wavelength field fluctuations are observed to agree with theory based on a test particle model. Simulation of the stabilizing properties of RF waves on the interchange instability are conducted on a two-dimensional plane perpendicular to the background magnetic field. RF-induced stabilizing ion drifts are found to be negligibly small both theoretically and in simulation.

15180 **Experimental investigation of compact toroid formation, dynamics, and plasma loss in a field reversed theta pinch.** Mead, F.B. Jr. University Park, PA; Pennsylvania State Univ. (1986). 167p. University Microfilms Order No. 86-23,783.

Thesis (Ph. D.).

Results of an experimental investigation of compact toroid formation, dynamics, and plasma loss in a 50-cm-long field reversed theta pinch are presented. A combination of radio frequency incipient ionization coupled with fast ringing theta discharges was used to trap a uniform 0.92 kG magnetic bias field in a deuterium gas over a 20 to 200 mtorr fill pressure range in a 9-cm diameter discharge tube. A reversed 4.54 kJ crowbarred discharge with a rise time of 3.4 μs was used to form compact toroids exhibiting lifetimes up to 60 μs. A diamagnetic loop, magnetic loop, magnetic probes, pressure probes, spectroscopy, photodiodes, and photography were used as diagnostics to investigate preionization, bias field generation, and trapping, stable lifetime characteristics, and eventual compact toroid destruction. Separatrix radius electron temperature, and electron density as a function of time and pressure are calculated from experimental data. Symmetry and rotational stability are illustrated over the lifetime of the compact toroids. Results indicate that like the Russian experiments but unlike the results at Los Alamos, compact toroids formed in the Penn State machine were limited in life by the decay characteristics of the applied magnetic field and not by the $n = 2$ rotational instability.

15181 **Tomographic analysis of the evolution of plasma cross sections in HBT.** Holland, A.K. New York, NY; Columbia Univ. (1986). vp.

Thesis.

A diagnostic was developed for measurements of the evolution of plasma density distributions in 2D using the principles of computed emission tomography. The system measures the near infrared emission along several chords through the plasma cross section, and the emission profile is then reconstructed using a maximum entropy based algorithm. Measurements were made on a poloidal cross section of the Columbia University high beta tokamak HBT. It was possible to determine the complete time history of the plasma density distribution during the tokamak phase of the discharge. Variations of the plasma location, size, and elongation were measured with a spatial resolution of about 2 cm. The reconstructed profiles were observed to be correlated with magnetic structure of the plasma. Correlation experiments were performed to show

that the density profile can be inferred from the square root of the infrared emission profile. The data obtained indicate that the discharges examined had betas from bout 15% to more than 24%. No evidence of MHD instability was seen, possibly because the 20 μs lifetime of the discharges was not long enough for any instabilities to grow large enough to be detected.

15182 **Growth rate, saturation, and radial transport for the trapped ion instability.** Plaut, A.B. New York, NY; Columbia Univ. (1986). 176p. University Microfilms Order No. 86-23,586.

Thesis (Ph. D.).

This dissipative trapped ion instability (DTII) is observed as an m = to the mirror cell of the Columbia Linear Machine (CLM). A gated feedback diagnostic was installed on CLM to allow the direct measurement of the DTII linear growth rate. The growth rate is measured by suppressing the DTII mode amplitude with feedback, abruptly gating the feedback loop open, and observing the free growth of the density fluctuations until nonlinear saturation is reached. This gated feedback experiment is typically performed 400 times in a few minutes, and the density fluctuation signals are recorded by a computer controlled data acquisition system. A numerical signal envelope detection scheme is used to simultaneously improve the signal-to-noise ratio and detect the growth envelope of the DTII induced density fluctuations. Growth rates are determined by curve fitting to an exponential function over the linear growth phases of the density fluctuation envelopes. The DTII growth rate is measured as a function of trapped fraction, keeping all other parameters fixed. The measured growth rates clearly display the scaling with trapped reaction predicted by the radially local linear dispersion relation, including ion Landau damping. The measurements are generally about 30% less than the predictions. Saturated DTII mode amplitudes are also measured from nearly linear dependence on the measured growth rates.

15183 **Plasma confinement in a spindle cusp magnetic field.** Bosch, R.A. Iowa City, IA; Univ. of Iowa (1986). 117p. University Microfilms Order No. 86-22,751.

Thesis (Ph. D.).

An experimental study of the confinement properties of a low (average) beta plasma in a spindle cusp magnetic field is described. An argon discharge plasma and a plasma produced by contact ionization of potassium were investigated. Electron and ion densities, space potentials, and plasma flow velocities were measured in the ring and point cusps. The leak width of the escaping plasma was measured over a wide range of magnetic field strengths and neutral gas pressures. The dependence of the leak width on neutral pressure and magnetic field strength is accounted for by a simple model is which plasma streams out of the cusps along the magnetic field lines while diffusing across the magnetic field due to the combined effects of neutral particle collisions and Bohm diffusion.

15184 **Properties of electrostatic ion-cyclotron waves in a nonuniform magnetic field and their association with strong, magnetized double layers.** Cartier, S.L. Iowa City, IA; Univ. of Iowa (1986). 188p. University Microfilms Order No. 86-22,753.

Thesis (Ph. D.).

The properties of coherent electrostatic ion-cyclotron (EIC) waves excited under various conditions are described. The experiments were carried out in a cesium Q-machine plasma and in an argon discharge column both having a region of nonuniform magnetic field. In the argon discharge, the waves were examined in the presence of strong, magnetized double layers. The double layers were produced in a weakly ionized plasma by applying a positive potential to a large anode plate located in the diverging magnetic field region. Ionization within the anode sheath is essential to the formation of these double layers. The resulting conical shaped potential structure have extended parallel, oblique, and perpendicular electric field components with respect to the magnetic field. The frequency of the EIC instability is dependent upon the magnetic field strength at the axial location of the parallel electric-field component. In a cesium plasma, the EIC instability is excited by drawing an electron current along the axis of the machine to a small positively biased exciter disk. The waves are quenched when the local ion Larmor radius exceeds the current channel radius; otherwise, the wave frequency, omega/2π, is found to depend on the location of the exciter disk in the nonuniform magnetic field. The formation of ion conics due to the heating of ions by EIC waves and their subsequent flow along diverging B-field lines is presented.

15185 **Nonlinear radial propagation of drift wave turbulence.** Prakash, M. New York, NY; Columbia University (1985). vp.

Linear and nonlinear radial propagation of drift-wave energy in an inhomogeneous plasma was studied. The drift mode excited in such a plasma is dispersive in nature. The drift-wave energy spreads out symmetrically along the direction of inhomogeneity with a finite group velocity. To study the effect of the nonlinear coupling on the propagation of energy in a collision free plasma, the Hasegawa-Mima equation is solved as a mixed initial boundary-value problem. Solutions of the linearized equation are used to check the reliability of the numerical calculations. Additional checks are also performed on the invariants of the system. Results reveal that a pulse gets distorted as it propagates through the medium. The peak of the pulse propagates with a finite velocity that depends on the amplitude of the initial pulse. The polarity of propagation depends on the initial parameters of the pulse. Also studied was drift wave propagation in a resistive plasma. The Hasegawsa-Wakatani equations are used to investigate this problem. Results of the numerical calculations show that the resistive drift wave grows as it propagates through the medium. For spatially dependent resistivity, the peak of the pulse propagates in the direction of decreasing resistivity. Polarity of propagation is independent of the phases of the initial pulse. Results of the calculations are explained framework of weak turbulence theory. These results provide qualitative insights into the phenomenon of drift wave turbulence observed in tokamak plasmas.

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REFER ALSO TO CITATION(S) 13761, 13763, 13786, 14054

15186 **(AD-A—173879/8/XAB) Fusion breeder reactor based on a catalyzed D-D spherical torus. Final report, 8 August 1986.** Wrisley, K.L. (Army Military Personnel Center, Alexandria, VA (USA)). 8 Aug 1986. 170p. NTIS, PC A08/MF A01.

One of the potentially attractive applications of nuclear fusion is to breed fissile fuel for use in fission reactors. This thesis examines a novel nonpower-producing fusion reactor based on the spherical torus concept with a catalyzed deuterium-deuterium fuel cycle and aqueous self-cooled blanket for use as a fissile breeder. The breeding of fissile fuel is accomplished by dissolving a uranium salt, uranyl nitrite, in heavy water which flows through the first wall and blanket providing both cooling and fissile breeding. The need for tritium breeding is eliminated by the use of a catalyzed D-D fuel cycle. Analysis of this novel reactor concept indicates a fissile breeding ratio of 1.34 Pu-239/source neutron using a 15-cm beryllium moderator and 7 mol% uranyl nitrite in the heavy water. A typical reactor using this blanket can produce more than 8000 kg/yr of plutonium at a cost of less than $40 per gram. This indicates the potential for a reactor which can provide fissile fuel at, or below, its current mined cost.

15187 **(CONF-861019—23) Retention of hydrogen in graphite.** Langley, R.A. (Oak Ridge National Lab., TN (USA)). Oct 1986. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE87004266.

From 10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society; Baltimore, MD, USA (27 Oct 1986).

The retention of hydrogen in POCO AXF-5Q graphite has been measured at room temperature as a function of fluence and flux for H_3^+ ions at energies from 250 to 500 eV provided by a glow discharge. More than 2 x 10^{18} H/cm^2 has been retained, and no indication of saturation has been observed to a fluence of 5 x 10^{19} H/cm^2. In this experiment, retention was found to increase linearly with fluence for constant flux. A flux dependence was observed; that is, the retention rate was observed to decrease monotonically as the flux increased. A change-over experiment, deuteri-

um to hydrogen, was conducted; the results show that significant change-over occurs (i.e., about 30% change-over for a fluence of 5 x 10^{17} D/cm^2).

15188 **(CONF-8609225—1-Vugraphs) Major new facilities.** Bloom, E.E. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87002816.

From Technical working party on the question of international collaboration in fusion materials research; Munich, F.R. Germany (1 Sep 1986).

Viewgraphs from the presentation are included. (MOW)

15189 **(DOE/ER/02490—4) Office of Basic Energy Sciences program to meet high priority nuclear data needs of the Office of Fusion Energy: 1986 review.** Lane, R.O. (Argonne National Lab., IL (USA); Ohio Univ., Athens (USA). John E. Edwards Accelerator Lab.). Sep 1986. Contract AC02-76ER02490;W-31-109-ENG-38. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87004296.

A coordination meeting of the program was held at Argonne National Laboratory on September 17-19, 1986. Representatives from the participating laboratories and from the fusion technology community met to discuss nuclear data needs for fusion. Most of the standing nuclear data requests for fusion were discussed in considerable detail, and the status of the relevant data was reviewed. Task force groups were organized along disciplinary lines to address many of the issues which confront the program. Plans were laid for several collaborative endeavors, including technical projects to address specific data problems and an intercomparison of methods and codes in the area of nuclear modeling.

15190 **(DOE/ER/13048—3) Feasibility study of a railgun as a driver for impact fusion: Final report.** Thio. Y.C. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jun 1986. Contract AC02-83ER13048. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE87004196.

The feasibility of a railgun as a driver for impact fusion is studied through a series of theoretical and experimental investigations. The results of both the theoretical and experimental investigations presented here have helped to identify the potential problems of the railgun launcher to attain velocity in excess of 100 km/s. These include ablation, viscous drag, and secondary arc formation due to either armature dispersion (instability) or restrike. These problems are analyzed and examined experimentally. The behavior of the conventional open-plasma-armature driven railguns have been shown to be quite complex and not easily controllable in the domain of ultrahigh velocity (>6 km/s). Methods to overcome these problems are proposed, analyzed in regards to their technological feasibility, and tested experimentally wherever possible. Techniques for reducing radiative ablation, the concept of a mechanically controlled plasma armature, and the concept of achieving super high augmentation by the technique of trans-augmentation are presented.

15191 **(DOE/ER/53164—13) Reversed field pinch experiments: Final report for period 9/26/83-12/24/86.** Robertson, S. (Colorado Univ., Boulder (USA)). 9 Jan 1987. Contract AC02-83ER53164. 12p. NTIS, PC A02/MF A01. File Number DE87004585.

A reversed field pinch plasma confinement device, the Reversatron (major radius 50 cm, minor radius 8 cm, 25 kA plasma current), has been constructed so that the conducting shell thought to be necessary for stability can be easily removed. After an initial period of operation in which discharges with the shell were characterized, a series of experiments without the shell showed (1) that the longest duration discharges are obtained with an externally applied vertical field adjusted to the Shafranov value, and (2) that these discharges are shorter in duration and more resistive than those with the shell. Subsequently an array of magnetic position probes was constructed to measure the position of the plasma at up to seven toroidal locations. The data show that the early terminations are associated with both vertical and horizontal motion of the plasma of up to 2 cm. Fourier analysis indicates that modes of n = 1,2, and 3 are present where n is the toroidal mode number. Higher order modes are not resolved. Similar behavior is seen when the Reversatron is operated in the "spheromak" mode with the applied toroidal field reduced to zero. The "spheromak" data are consistent with numerous MHD simulations which show the spheromak to be unstable to low order kink modes.

15192 **(DOE/ER/53203—1) Magnetic surface mapping with an emissive filament technique on the Auburn Torsatron: Technical report.** Gandy, R.F.; Henderson, M.A.; Hanson, J.D.; Hartwell, G.J.; Swanson, D.G. (Auburn Univ., AL (USA). Dept. of Physics). Oct 1986. Contract FG05-85ER53203. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87003979.

Torsatron and stellarator plasma confinement devices rely on magnetic surface mapping to determine the critical vacuum magnetic field structure. A recently developed method employing an emissive filament offers some advantages over the traditional technique of mapping with a directed electron beam. On the Auburn Torsatron a comparative study between the emissive filament and directed electron beam techniques has been conducted. The parameters varied in the comparative study are: filament geometry, emission current, bias voltage, background gas pressure, and magnetic field strength. This comparative study indicates that the emissive filament technique is reliable over a broad and easily accessible range of parameters. We have also measured the spatial distribution of electrons on a given magnetic surface. As an application of the emissive filament technique, the optimization of the magnetic surfaces on the Auburn Torsatron is shown.

15193 **(EGG-M—34886) Computer codes for safety analysis.** Holland, D.F. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1986. Contract AC07-76ID01570. 17p. (CONF-861143—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004533.

From IAEA technical committee meeting on fusion reactor safety; Culham, UK (3 Nov 1986).

Computer codes for fusion safety analysis have been under development in the United States for about a decade. This paper will discuss five codes that are currently under development by the Fusion Safety Program. The purpose and capability of each code will be presented, a sample given, followed by a discussion of the present status and future development plans.

15194 **(HEDL—7585) Activation calculations using an expanded data base.** Mann, F.M. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1986. Contract AC06-76FF02170. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004341.

Using an expanded nuclear data base, the activation of nitrogen, aluminum, iron, nickel, copper, zirconium, niobium, molybdenum, tungsten, and lead were calculated for the first wall positions of the STARFIRE and MARS conceptual fusion reactors.

15195 **(LA—10830-C) Proceedings of the seventh symposium on the physics and technology of compact toroids in the Magnetic Fusion Energy Program.** Sherwood, A.R. (comp.). (Los Alamos National Lab., NM (USA)). Sep 1986. Contract W-7405-ENG-36. 222p. (CONF-8505100—). NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE87003801.

From 7. symposium on the physics and technology of compact toroids in the magnetic fusion energy program; Santa Fe, NM, USA (21 May 1985).

The Seventh Symposium on Compact Toroid (CT) Research was held in Santa Fe, New Mexico, on May 21-23, 1985. As has been the case for the last few CT symposia, CT research progress was reported in a combination of invited talks and poster sessions. The following record of these presentations in the form of four page papers is in keeping with the format followed in previous years. We have continued the practice of dividing the papers into three subject categories - spheromak, FRC (Field Reversed Configuration), and other (mostly particle rings).

15196 **(NRL-MR—5829) Use of incoherence to produce smooth and controllable irradiation profiles with KrF fusion lasers.** Lehmberg, R.H.; Goldhar, J. (Naval Research Lab., Washington, DC (USA). Plasma Physics Div.). 14 Aug 1986. Contract AI08-79DP40092. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87000784.

A technique called Echelon-Free Induced Spatial Incoherence, is proposed for producing smooth, controllable target beam profiles with large KrF fusion lasers. The idea is basically an image projection technique that projects the desired time-averaged spatial profile F(x) onto the target via the laser system, using partially-coherent broadband light. The information needed to reproduce F(x) is transported through the system by a multitude of independent coherence zones, whose diameters are small in comparison to scale lengths of linear aberration and gain nonuniformities; as a result, F(x) remains relatively insensitive to these effects. This concept is closely related to the Induced Spatial Incoherence (ISI) technique used with glass lasers, except that it does not require echelons at the output of the system. An analysis is carried out to evaluate the perturbations of F(x) due to linear aberration, self-focusing, gain saturation, and diffraction. It shows that under conditions applicable to large KrF lasers, the perturbations will result in a small broadening and smoothing of F(x), whose functional form should be controllable to within a few percent. The ability of this technique to generate smooth focal profiles is demonstrated using a small KrF discharge oscillator-preamplifier system.

15197 **(SAND—86-1675C) Power oscillator circuit modeling and redesign for the Particle Beam Fusion Accelerator II (PBFA-II) switch trigger laser.** Smith, D.L.; Hamil, R.A.; Prestwich, K.R.; Rohwein, G.J.; Donovan, G.L.; Schaub, C.M. (Sandia National Labs., Albuquerque, NM (USA)). 1987. Contract AC04-76DP00789. 20p. (CONF-870132—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87003774.

From LASE-13: pulse power for lasers conference; Los Angeles, CA, USA (11 Jan 1987).

The energy output and reliability of the multi-joule, injection-locked KrF laser used to trigger the PBFA II accelerator gas switches were improved through modifications identified in modeling the Blumlein driver circuit for the power oscillator. A combination of the SCEPTRE network solver code and JASON electrostatic field code were used to model the laser pulse-forming circuit in its single-channel rail gap configuration and modified versions with three or five discrete switches across the 1.45 m wide water-insulated transmission line. Three regularly spaced trigatron spark gaps resulted in a more uniformly driven laser volume with lower variations in voltages (10%) and rise times (9%) along its length. With the new configuration over 3000 shots have been recorded without a single misfire compared to an average of ~25 shots before a prefire with the original design. The gas mix and pressure had to be optimized to match a given driver pulse voltage and rise time to achieve maximum performance from the laser. We summarize the model results which led to our decision to change the Blumlein switch configuration.

15198 **(SAND—86-2011C) Engineering considerations for the Tore Supra pump limiter.** Whitley, J.B.; Koski, J.A.; Aymar, R. (Sandia National Labs., Albuquerque, NM (USA); Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1986. Contract AC04-76DP00789. 9p. (CONF-860917—13). NTIS, PC A02/MF A01. File Number DE87003506.

From 14. SOFT - symposium on fusion technology; Avignon, France (8 Sep 1986).

The Tore Supra pump limiter project is a collaboration between Sandia National Laboratories and Oak Ridge National Laboratories in the US and the Association Euratom-CEA at Cadarache, France. The long pulse length and high power levels of Tore Supra, coupled with the desire to remove the maximum practical number of particles, have driven the pump limiter design beyond that ever before experienced. The engineering considerations going into this design are reviewed and several preliminary designs are discussed.

15199 (UCLA-ENG—86-38, pp 1.1-1.35) **Executive summary.** Ghoniem, N.M.; Firestone, M.A.; Conn, R.W. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

Reactor system operation and procedures have a profound impact on the conception and design of power plants. These issues are studied here using a model tokamak system employing a solid-breeder blanket. The model blanket is one which has evolved from the STARFIRE and BCSS studies. The reactor parameters are similar to those characterizing near-term fusion engineering reactors such as INTOR or NET (Next European Tokamak). Plasma start-up, burn analysis, and methods for operation at various levels of output power are studied. A critical, and complicating, element is found to be the self-consistent electromagnetic response of the system, including the presence of the blanket and the resulting forces and loadings. Fractional power operation, and the strategy for burn control, is found to vary depending on the scaling law for energy confinement, and an extensive study is reported. Full-power reactor operation is at a neutron wall loading of 5 MW/m^2 and a surface heat flux of 1 MW/m^2. The blanket is a pressurized steel module with bare beryllium rods and low-activation HT-9-(9-C-)clad $LiAlO_2$ rods. The helium coolant pressure is 5 MPa, entering the module at 297°C and existing at 550°C. The system power output is rated at 1000 MW(e). In this report, the authors present their findings on various operational scenarios and their impact on system design. They first start with the salient aspects of operational physics. Time-dependent analyses of the blanket and balance of plant are then presented.

15200 (UCLA-ENG—86-38, pp 2.1-2.5) **Summary of tokamak machine physics parameters.** Kessel, C.E.; Firestone, M.A. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

The purpose of this study is to develop the tools necessary to examine the transient behavior or tokamak fusion reactors in order to gain a better understanding of the system and to arrive at implications for design. Since the purpose was not to design a machine, one existing conceptual design was chosen, the INTOR design. This particular machine reflects the trends for future tokamak reactors, but has enough previous analysis to be well-defined. The primary reason for this choice is the extensive magnet design and optimization. The INTOR machine has a blanket configuration, although smaller than those predicted for reactors, which is sufficient to examine eddy current effects. The design can be used with a divertor or limiter, although only the limiter option is examined. The machine design, although in an advanced stage, is quite flexible for analysis. A schematic of the INTOR tokamak is given and reactor specifications and plasma parameters for this study are listed.

15201 (UCLA-ENG—86-38, pp 3.1-3.58) **Fractional power operation of tokamak reactors.** Mau, T.K.; Vold, E.L.; Conn, R.W. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

Methods to operate a tokamak fusion reactor at fractions of its rated power, identify the more effective control knobs and assess the impact of the requirements of fractional power operation on full power reactor design are explored. In particular, the role of burn control in maintaining the plasma at thermal equilibrium throughout these operations is studied. As a prerequisite to this task, the critical physics issues relevant to reactor performance predictions are examined and some insight into their impact on fractional power operation is offered. The basic tool of analysis consists of a zero-dimensional (0-D) time-dependent plasma power balance code which incorporates the most advanced data base and models in transport and burn plasma physics relevant to tokamaks. Because the plasma power balance is dominated by the transport loss and given the large uncertainty in the confinement model, the authors

have studied the problem for a wide range of energy confinement scalings. The results of this analysis form the basis for studying the temporal behavior of the plasma under various thermal control mechanisms. Scenarios of thermally stable full and fractional power operations have been determined for a variety of transport models, with either passive or active feedback burn control. Important power control parameters, such as gas fueling rate, auxiliary power and other plasma quantities that affect transport losses, have also been identified. The results of these studies vary with the individual transport scaling used and, in particular, with respect to the effect of alpha heating power on confinement.

15202 (UCLA-ENG—86-38, pp 4.1-4.13) **Plasma position and shape determination and electromagnetics calculations.** Kessel, C.E.; Firestone, M.A. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

The rapid calculation of gross plasma equilibrium parameters is necessary in a dynamic system description in order to determine the effects of changes in the electromagnetic environment on the plasma. Since this would involve a free boundary MHD calculation at each time step, and there are a large number of time steps in a discharge simulation, the use of conventional equilibrium calculations is excluded. It is thus required that a new approximate technique be developed that can yield the necessary plasma parameters, such as major radius, elongation and triangularity, in an acceptable computation time. A method has been developed to perform this task. The shape parameters are determined from magnetic multipoles of the externally applied magnetic field from the poloidal field coils and eddy currents. In order to relate the multipoles to plasma position and shape parameters, several fixed/free boundary MHD equilibrium calculations have been done using NEQ developed at ORNL/FEDC. The plasma shape and position are specified and the required coil current determined. These coil currents are calculated interactively with the plasma internal conditions, such as current distribution and pressure profile. With the coil currents the poloidal magnetic field along the midplane can be calculated and from it the multipoles can be determined. These multipoles are then related to the plasma elongation and triangularity.

15203 (UCLA-ENG—86-38, pp 5.1-5.4) **Eddy current models.** Firestone, M.A.; Brown, D.I.; Kessel, C.E.; Tillack, M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

Electromagnetic effects on plasma behavior pose important design constraints for tokamak reactors. While the poloidal field coils are carefully studied in reactor designs, the passive poloidal field system, i.e., eddy currents, are not. The coupling between the plasma, poloidal field coils, and eddy currents in the vessel and surrounding structure is complex and dependent on the plasma discharge and burn cycle time history. Additionally, reactors have a thick blanket/shield structure between the plasma and poloidal field coils which enhances the importance of this coupling. A simple, but realistic eddy current model of the vacuum vessel and blanket/shield which can be utilized in an accurate assessment of the electromagnetic influences of a given design is presented.

15204 (UCLA-ENG—86-38, pp 6.1-6.29) **Modeling of lower hybrid current drive in tokamak reactors.** Mau, T.K.; Ilgen, M.R.; Conn, R.W. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

The physics and engineering issues related to time-dependent lower hybrid current drive in a reactor, and their impact on reactor start-up and, indirectly, on fractional power operation are examined. A one-dimensional model is used to describe the physical processes during current ramping. The RF analysis is simplified in that wave damping is calculated analytically using a quasilinear approximation while the local driven current is obtained by applying the Fisch-Karney formula. The 3-D, LH ray tracing code is then coupled to WHIST, a 1 1/2-D transport, magnetohydrodynamic (mhd) equilibrium code developed at Oak Ridge. Self-consistent flux surface geometry, plasma current and pressure profiles can then be used to study issues related to the power balance and mhd stability during the transient current drive phase of reactor operation. Methods to optimize the ramp-up scenario under various criteria, e.g, minimum energy input, have been explored. The work presented in this chapter can also form the basis for detailed modeling of the transition phase between ohmic and LH current drive for the hybrid transformer mode of operation.

15205 (UCLA-ENG—86-38, pp 7.1-7.7) **Plasma circuit interaction code.** Firestone, M.A. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

A computer code which combines plasma particle and energy balance together with the electromagnetic coupling between the plasma and the engineering systems has been developed. The latter include both active poloidal field coils and the fields due to passive eddy currents in the surrounding structures. A TFTR code, PCIC had been modified to include features expected in a power producing tokamak. This modeling effort has been previously described in the report and consists of plasma position and shape techniques, eddy currents in a thick inhomogeneous structure, and lower hybrid current drive. Additionally, an alpha particle heating model has also been incorporated in the new code.

15206 (UCLA-ENG—86-38, pp 8.1-8.18) **Neutronic optimization of a $LiAlO_2$ solid breeder blanket.** Levin, P.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

In this report, a pressurized lobular blanket configuration is neutronically optimized. The blanket configuration features the use of beryllium and $LiAlO_2$ solid breeder pins in a helium-cooled cross-flow pattern. One-dimensional (1-D) neutronic optimization calculations are performed to maximize the tritium breeding ratio (TBR). The procedure involves spatial allocations of Be, $LiAlO_2$, 9-C (ferritic steel), and He, in such a way as to maximize the TBR subject to several material, engineering, and geometrical constraints. Consistent with all imposed engineering constraints, a TBR of 1.17 is achieved for a relatively thin blanket (~43 cm depth).

15207 (UCLA-ENG—86-38, pp 9.1-9.51) **Modeling of tritium transport in a pin-type solid breeder blanket.** Martin, R.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

This section of the pin-type solid breeder blanket study is the first detailed attempt at modeling tritium inventory and release within a fusion reactor blanket based on actual tritium generation and thermal hydraulic profiles, rather, than a simple average unit cell extrapolation or some assumed exponential profiles. The DIFFUSE 83 code was found to give inventory results consistent with previous modeling efforts and with the general spherical grain model. The inventories for this blanket design calculated using DIFFUSE were found to be very satisfactory, less than 14 g at steady-state for a 129,000 kg $LiAlO_2$ blanket. This result is reasonable compared with a BCSS $LiALO_2$ blanket inventory calculated by GA Technologies. DIFFUSE was found to be very useful in approximating tritium inventories during transient startup/shutdown modes. The evaluations of transient inventories in this study appear to be the most detailed to date. The results suggest the need for controlling coolant flow during start-up to maintain high breeder temperatures and low tritium inventory, and the use of pre-heated coolant to bake out tritium inventory after shut-down. DIFFUSE modeling of breeder pins of 100% theoretical density indicates very limited tritium release from the $LiAlO_2$ ceramic, suggesting batch processing of the pins for tritium extraction at the end of blanket

lifetime. Preliminary analysis of other surface and radiative trapping effects shows DIFFUSE to be potentially a very useful tool in approximating and evaluating experimental results. Additional DIFFUSE analysis of these effects given the available experimental data is warranted.

15208 (UCLA-ENG—86-38, pp 15.1-15.25) **Model for the mechanical pellet-cladding interaction during power cycles.** Orient, G.E.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

Solid breeders have a relatively low fracture strength and poor mechanical properties. Their ability to withstand mechanical loads and thermal gradients is greatly reduced, leading to intolerable design limits. Another problem with solid breeder materials is the high retention of tritium and helium if the breeder is fully dense. To allow for tritium diffusion, and as a practical solution to their mechanical problems, solid breeders can be produced as porous square cylinders of dimensions on the order of 1-3 cm. Such cylinders, called pellets, are encapsuled in a structural cladding material which provide for a barrier to their interaction with the coolant. Moreover, the cladding material carries existing structural and thermal loads. In order to minimize maintenance time, a satisfactory configuration has to withstand transient phenomena associated with power-ramps and shutdowns while giving optimal thermomechanical performance in reasonable lifetime. These objectives can be reached by selecting suitable geometry and material specifications as well as prescribed temperature histories. Finding the minimal allowable ramp rate for startup is important form the economy of the operation, since overly conservative startup can amount to substantial percentage of the power cycle. In the stage of preliminary design the main concern is failure of the cladding due to high stresses or large total strains. The following analysis provides a simplified tool for design based on macroscopic mechanical interaction between the breeder and the cladding. The next most important effect to include in the analysis phenomena associated with failure of materials at the micro-scale such as stress corrosion, creep fracture and fatigue.

15209 (UCLA-ENG—86-38, pp 10.1-10.48) **Materials data base and design equations for the UCLA solid breeder blanket.** Sharafat, S.; Amodeo, R.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

The need for a complete and coherent material data base for fusion reactor systems has been an important issue for some time now. Since the choices for materials used in fusion reactors are becoming more apparent, it is important to be able to quickly access this data to facilitate reactor design. The philosophy of a data base is one of expansion and modification. This will lead to a constantly growing collection of most recently acquired information. Based on this philosophy special care has been given to the structure, the accessibility and ease of modification. The data base is developed primarily for use on Personal Computers (PC's). In Section 10.2. materials and properties investigated for this blanket study are listed. Section 10.3. is a list of phenomenological equations and mathematical fits for all materials and properties considered. Section 10.4. describes the authors efforts to develop a swelling equations based on the few experimental data points available for breeder materials. In Section 10.5. the sintering phenomena for ceramics is investigated.

15210 (UCLA-ENG—86-38, pp 11.1-11.31) **Thermal response of a pin-type fusion reactor blanket during steady and transient reactor operation.** Grotz, S.P.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

The thermal analysis of the blanket examines both the steady-state and transient reactor operations. The steady-state analysis covers full power and fractional power operation whereas the transient analysis examines the effects of power ramps and blanket preheat. The blanket configuration chosen for this study is a helium cooled solid breeder design. The blanket design is summarized below. The full power, steady-state temperature fields in the first wall, beryllium rods, and breeder rods are discussed. The effects of fractional power on coolant flow and temperature field distributions are examined. This includes power plateaus of 10%, 20%, 50%, 80%, and 100% of full power. Also examined are the restrictions on the rates of power ramping between plateaus. Finally the power and time requirements for pre-heating the primary loop from cold iron conditions up to startup temperature (250°C) are discussed.

15211 (UCLA-ENG—86-38, pp 12.1-12.27) **Thermomechanical analysis of solid breeders in sphere-pac, plate, and pellet configurations.** Blanchard, J.P.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

Fusion blankets featuring solid breeders have been proposed in many different configurations. In this report the thermomechanical behavior of three common configuration are assessed and the implications for blanket design are discussed. The first configuration studied is called sphere-pac. It features small breeder spheres of three different diameters, thus allowing efficient packing and minimal void fraction. The concept originated as an attempt to minimize thermal stresses in the breeder and improve the predictability of the breeder-structure interface heat conduction. It remains a viable option for commercial fusion. The second concept features plates of solid breeder wrapped with thin steel cladding. The thermal stresses in large plates can reach high levels, so small rectangular blocks will be used in most designs. This shifts much of the load to the cladding, which should be thin for good breeding and thick for good mechanical strength. In general the breeder is made as thin as possible, to maximize the breeding ratio, so the cladding's integrity will likely be the life-limiting issue of this concept. The third breeder configuration is in the form of pellets cladded by steel tubes.

15212 (UCLA-ENG—86-38, pp 13.1-13.12) **Bowing of solid breeder fuel pins and multiplier rods in a pin-type fusion blanket.** Blanchard, J.P.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

When a solid breeder is encased in a metal tube, its designer must use analyses of both the deflections and stresses in order to determine the number and type of supports to construct along the rod. For a thorough analysis, one must include such loads as thermal expansion, body weight of both the pellets and tube, and swelling. In addition, models for thermal and irradiation creep must be incorporated to model time-dependent response. For this report, analytical methods will be used to allow use of the most general, up-to-date material models. The breeder rods are modeled as Euler beams which are simply supported at each end and in the center. The most important outcome of this bowing analysis is the determination of the number of internal breeder rod supports required for good thermal performance. Although many effects were considered, the swelling deformations were the most restrictive in terms of the peak deflections. It appears that three internal supports should be sufficient to deep the rod bowing below acceptable levels without significantly raising the structure-to-breeder ratio. The most severe interaction problem involved the last multiplier row and the first breeder row. Because the Be rods deflect very little, this problem can be alleviated by leaving enough space between these two zones. The spacing can be tighter elsewhere.

15213 (UCLA-ENG—86-38, pp 14.1-14.17) **Elastic structural analysis of the pin-type solid breeder blanket first wall.** Orient, G.E.; Ghoniem, N.M. Sep 1986. NTIS, PC A18/MF A01. File Number DE87002996. (UCLA/PPG—1009).

In TOKOPS: Tokamak Reactor Operations Study: The influence of reactor operations on the design and performance of tokamaks with solid-breeder blankets: Final report.

A key to the successful design of a fusion blanket is the distribution of the amount of structural material in the first wall and the blanket enclosing structure. The first wall must support dynamic and static mechanical loads and at the same time sustain the thermal gradients and erosion resulting from the plasma heat and particle fluxes. Dynamic and static loads require high flexural rigidity, which is influenced by flow channels designed to cool the high heat flux incident on the first wall. Since the first wall temperature is roughly proportional to its thickness, thermal stresses require a thin first wall. On the other hand, a thick wall is necessary to withstand surface erosion due to particle fluxes. A feasible design must therefore represent an optimal solution satisfying such conflicting requirements. To address some of the issues described above and gain some insight into scaling, a displacement type finite element model, based on classical beam theory, has been developed. The model is described and sample calculations are presented.

15214 **(UCRL—94058) Recent progress in heavy-ion fusion in the US.** Bangerter, R.O. (Lawrence Livermore National Lab., CA (USA)). 29 Aug 1986. Contract W-7405-ENG-48. 6p. (CONF-860601—12). NTIS, PC A02/MF A01. File Number DE87003519.

From 4. international conference on emerging nuclear energy systems; Madrid, Spain (30 Jun 1986).

Recent developments in accelerator physics and technology have led to lower cost estimates for a heavy-ion induction linac driver. Studies show that the cost of electricity produced using such a driver are competitive with other fusion systems at a plant capacity of 1.2 GW/sub e/ and are competitive with projected fission power costs at less than 4 GW/sub e/.

15215 **Fusion Reactor Design IV.** Abdou, M.A.; Bertolini, E.; Hancox, R. (University of California, USA; Commission of the European Communities, Abingdon, UK. JET Joint Undertaking; UKAEA Headquarters, London). *Nuclear Fusion;* **26**: No. 10, 1377-1428(Oct 1986).

This paper contains a summary of the fourth Technical Committee Meeting and Workshop on Fusion Reactor Design and Technology. Workshops were held on the following topics: near-term tokamaks, long-term tokamak reactors, stellarators, magnet systems, inertial confinement fusion, hybrid fusion-fission reactors, alternative fusion concepts, and fusion nuclear technologies and materials. Refs, figs and tabs.

15216 **Studies of population inversions in the soft x-ray spectral region in CO_2 laser produced plasmas.** Keane, C.J. Princeton, NJ; Princeton Univ. (1986). 231p. University Microfilms Order No. 86-21,731.

Thesis (Ph. D.).

The recombination approach for development of a short wavelength laser is one of two schemes used in recent demonstrations of high gain in the soft x-ray region. In this work, a theoretical and experimental study of recombination pumped soft x-ray population inversions in Li-like carbon (CIV) and H-like carbon (CVI) in CO_2 laser produced plasmas is presented. A collisional radiative model is used to examine the behavior of the gain coefficients for various transitions in the C^{6+} ion with plasma parameters, and the optimum conditions for gain defined. A general formalism that elucidates the separate roles of radiative power loss and electron cooling in dense transient plasmas is described: it is used to examine the feasibility of quickly radiatively cooling a dense plasma to bring about optimum conditions for gain in a recombination system. Experimental studies of the effectiveness of radiation cooling in generating recombination pumped soft x-ray population inversions in CIV are carried out in freely expanding CO_2 laser produced plasmas. Measurements of gain length products as high as 6.5 on the 182 A transition in CVI in magnetically confined CO_2 laser produced plasmas are reviewed and observations of stimulated emission at 182 A obtained with an XUV multilayer mirror in use are presented.

99 GENERAL AND MISCELLANEOUS

15217 **(DOE/MA/00194—H1) Report on 1986 national survey of compensation paid scientists and engineers engaged in research and development activities.** (Battelle Columbus Div., OH (USA)). Jan 1987. Contract AC02-85MA00194. 362p. NTIS, PC A16. File Number DE87004570.

In November of 1966, the United States Department of Energy awarded a contract to the Columbus Division of Battelle to design a survey of compensation paid to scientific and engineering personnel engaged in research and development in the United States. This survey utilized the maturity or "age-wage" approach, under which salary data would be related to years since receipt or degree of chronological age. This document reports the results of the eighteenth annual survey, with a salary effective data of February 1, 1986.

15218 **(DOE/TIC—4579-Rev.14-Pt.1) Energy Data Base: Serial titles with ISSN listing: Part 1, Alphabetic arrangement by title.** Daniel, J.H. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Dec 1986. 960p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE87000365.

"Serial Titles with ISSN Listing" lists periodical titles which have been included in the OSTI (Office of Scientific and Technical Information) Journal Authority. The OSTI Journal Authority was established to standardize the citing of the approximately 23,000 titles contained in this authority. It is also a valuable tool for identifying journals by ISSN and CODEN, especially for journals with the same title which are published in different locations. This Part 1 is an alphabetical listing by full title of the journal publication and also includes abbreviated title, CODEN, ISSN, coverage code, and country code.

15219 **(DOE/TIC—4579-Rev.14-Pt.2) Energy Data Base: Serial titles with ISSN listing: Part 2, Numerical arrangement by ISSN.** Daniel, J.H. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Dec 1986. 371p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE87000366.

"Serial Titles with ISSN Listing" lists periodical titles which have been included in the OSTI (Office of Scientific and Technical Information) Journal Authority. The OSTI Journal Authority was established to standardize the citing of the approximately 23,000 titles contained in this authority.

15220 **(SOL—86-15) Thoughts on computing market equilibrium with SLCP.** Eaves, B.C. (Stanford Univ., CA (USA). Systems Optimization Lab.). Nov 1986. Contract AS03-76ER72018. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87004795.

Over the last several years Mathiesen has routinely solved, with remarkable robustness and speed various market equilibrium problems with hundreds of variables. The algorithm employed is an SLCP scheme, that is, it solves a sequence of Linear Complementary Problems. Our concern is that there is very little theoretical understanding, but not for lack of effort, of this algorithm. We continue the pursuit of an alternative SLCP which appears to lend itself more easily to theoretical analysis. 25 refs.

9901 Management

REFER ALSO TO CITATION(S) 13202, 15237

15221 **(CONF-870130—1) Professional ethics and the responsible engineer.** Vaughen, V.C.A. (Oak Ridge National Lab., TN (USA)). Jan 1987. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004281.

From Technical Society of Knoxville meeting; Knoxville, TN, USA (5 Jan 1987).

There are five basic ethical principles: truth, honesty, trustworthiness; respect for human life; welfare; and posterity; fair play; openness; and competence. A process has to be established to avoid

ethical crises. The NRC procedure for differing professional opinions is outlined. (DLC)

15222 (CONF-8610178—3) Nonreactor nuclear facility training at the Oak Ridge National Laboratory. Speas, I.G. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. File Number DE87001826.

From TRADE conference; Las Vegas, NV, USA (27 Oct 1986).

This presentation addresses the efforts under way to develop more formalized training programs for supervisors and operators of seven ORNL nonreactor nuclear facilities to comply with DOE Order 5480.1A, Chapter V, "Safety of Nuclear Facilities." Motivational factors which have focused increased attention on training and the methodology used to evaluate and upgrade existing training programs are discussed.

15223 (DOE/MA—0286) Department of Energy annual procurement and financial assistance report, FY 1986. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Procurement Support). Jan 1987. 37p. NTIS, PC A03/MF A01. File Number DE87005266.

DOE is generally not a consumer of the technology it develops, nor does it procure production quantities of hardware for its own use. DOE is involved in basic and applied research in nuclear energy, nuclear waste management, fossil energy, conservation, renewable energy, and nuclear weapons development. The DOE procurement activities also support national security in the production and testing of nuclear weapons, and the management of the Strategic Petroleum Reserve and the Naval Petroleum and Oil Shale Reserves. DOE spends its procurement dollars more as a catalyst for technology development than for acquiring goods and services for federal use. DOE enters into contractual arrangements with large and small firms involved in the technology areas for which it is responsible. In addition, DOE is involved in contractual and financial assistance activities with educational institutions, nonprofit organizations, and state and local governments.

15224 (SOL—86-14) A flexible manufacturing and operator scheduling model solved by deconvexification over time. Eaves, B.C.; Rothblum, U.G. (Stanford Univ., CA (USA). Systems Optimization Lab.). Sep 1986. Contract AS03-76ER72018. 42p. NTIS, PC A03/MF A01. File Number DE87004794.

A flexible manufacturing and operator scheduling problem is introduced and solved. The principle concern is with scheduling operators over time to various activities of a manufacturing system with the purpose of optimizing some steady state criterion. In mathematical terms the problems is modeled as a deterministic, mixed integer, infinite horizon dynamic program. Our solution procedure is first to convexify the problem, then to apply linear programming, and finally to deconvexify the solution over time to arrive at an optimal solution. Apparent loss in object value due to the deconvexifications is circumvented with buffer inventories. The procedure can be reduced to solving a sequence of linear programs and the complexity is stated in these terms.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 13506, 13667, 13945, 13946, 13991, 14564

15225 (AD-A—173178/5/XAB) Scientific computation and mathematical modeling. Final technical report, 11 January 1985-10 January 1986. Miller; Sell; Weinberger. (Minnesota Univ., St. Paul (USA). Inst. for Mathematics and Its Applications). 17 Feb 1986. 9p. (U-OF-M—0634-5139). NTIS, PC A02/MF A01.

This is the final technical report for an equipment grant that provided microcomputers in individual offices to be used as research tools by faculty in the School of Mathematics and participants in the programs of the Institute for Mathematics and Its Applications. Many research projects are underway; also mathematical software is being developed for use in the Dynamical Systems, Stochastic Modeling and Combinatorics Laboratories. The microcomputers will soon be linked by an Ethernet and are serving as terminals for access to the University's CRAY 2 supercomputer.

15226 (AD-A—173774/1/XAB) Real-time implementation of nonlinear optical processing functions. Annual technical report, 1 September 1984-31 August 1985. Soffer, B.H.; Marom, E.; Owechko, Y. (Hughes Research Labs., Malibu, CA (USA)). May 1986. 40p. NTIS, PC A03/MF A01.

Optical-data processing has not yet achieved its potential of increased capacity and speed compared with conventional electronic techniques and has been almost exclusively limited to linear operations. The continuing research outlined in this report attacks these issues by studying the implementation of real-time nonlinear parallel-processing techniques. The various implementations studied in this program all employed real-time liquid-crystal light valves developed and specially modified for these tasks by Hughes Research Laboratories. One approach investigated early in the program was to modify and characterize the twisted-nematic liquid-crystal (LC) devices, and then use them in a coherent optical data-processing apparatus using special half-tone screen masks, custom designed for special functions at USC in a cooperative effort under an AFOSR grant. Using the half-tone mask technique, were demonstrated logarithmic nonlinear transformation, permitting us to simplify multiplicative images and perform homorphic filtering.

15227 (AD-A—173844/2/XAB) Performance of the NEC SX-2 supercomputer system compared with that of the CRAY X-MP/4 and Fujitsu VP-200. Technical report, April-August 1986. Mendez, R.H. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1986. 26p. (NPS—53-86-011). NTIS, PC A03/MF A01.

A summary of the scalar performance of the CRAY X-MP/4, Fujitsu VP-200, and NEC SX-2 is given. The architecture, hardware and basic technology of SX-2 are described.

15228 (AD-A—173961/4/XAB) Convergence analysis and acceleration of the Schwartz alternating method. Oliger; Skamarock; Tang. (Stanford Univ., CA (USA). Center for Large Scale Scientific Computation). 26 Aug 1986. 26p. (CLASSIC—86-12). NTIS, PC A03/MF A01.

The convergence rate of the Schwarz Alternating Method(SAM) is studied for applications involving the solution of elliptic equations on composite grids. Such problems arise when solvers which can only be used on special domains, such as rectangles, are used for more general region; and in the disection of problems for parallel processing. It is shown that the convergence rate is a function of the overlap, number, and shape of the subregions into which the problem domain is divided. The convergence rates for SAM are slow, and an accelerated method based on overrelaxation techniques is developed. The SAM analysis is extended to predict the performance of the accelerated method and optimal relaxation parameters. Finally, the effects of changing the iteration order for the SAM and accelerated SAM methods are studied.

15229 (AD-A—173989/5/XAB) Serial order: a parallel distributed processing approach. Technical report, June 1985-March 1986. Jordan, M.I. (California Univ., San Diego, La Jolla (USA). Inst. for Cognitive Science). May 1986. 57p. (ICS—8604). NTIS, PC A04/MF A01.

A theory of serial order is proposed that attempts to deal both with the classical problem of the temporal organization of internally generated action sequences as well as with certain of the parallel aspects of sequential behavior. The theory describes a dynamical system that is embodied as a parallel distributed processing or connectionist network. The trajectories of this dynamical system come to follow desired paths corresponding to particular action sequences as a result of a learning process during which constraints are imposed on the system. These constraints enforce sequentiality where necessary and, as they are relaxed, performance becomes more parallel. The theory is applied to the problem of coarticulation in speech production and simulation experiments are presented.

15230 (AD-A—174281/6/XAB) Beta operations: efficient implementation of a primitive parallel operation. Technical report. Cohn, E.R.; Haddad, R.W. (Stanford Univ., CA (USA). Dept. of Computer Science). Aug 1986. 20p. (STAN-CS—86-1129). NTIS, PC A02/MF A01.

The ever-decreasing cost of computer processors has created a great interest in multi-processor computers. However, along with the increased power that this parallelism brings comes increased complexity in programming. One approach to lessening this complexity is to provide the programmer with general-purpose parallel primitives that shield him from the structure of the underlying machine. In The Connection Machine, Hillis suggests the beta operation as a parallel primitive for his hypercube-based machine. This paper explores efficient ways to perform this operation on several different well known architectures, including the hypercube. It presents some lower bounds associated with the problem.

15231 (AD-A—174506/6/XAB) Cooperative intelligence for remotely piloted vehicle fleet control. Analysis and simulation. Interim report. Steeb; Cammarata; Narain; Rothenberg; Giuarla. (RAND Corp., Santa Monica, CA (USA)). Oct 1986. 69p. (RAND/R—3408-ARPA). NTIS, PC A04/MF A01.

Cooperative behavior, by either humans or machines, is necessary for solving problems that, because of time or other physical constraints, cannot be solved by one agent acting alone. Complex, spatially distributed military systems, such as tactical air operations, Naval task force control, and command and control networks frequently rely on cooperative problem solving. This report develops aspects of coordinating groups RPV's in a surveillance mission. The findings suggest that (1) a combination of object-oriented simulation and logic programming appears to provide an effective framework for exploring and implementing distributed problem-solving systems, and (2) choice of task negotiation procedure, message passing protocol, planning algorithm, and uncertainty representation technique depends strongly on situational conditions such as time stress, communication costs, and number of planning options.

15232 (AREAEE—276) POLFIT: a computer routine for curve fitting and data smoothing using orthogonal polynomials. El-Osery, I.A. (Nuclear Research Centre, Inshas (Egypt)). 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780560.

The paper describes the computer routine "POLFIT" developed for curve fitting and data smoothing using orthogonal polynomials. The theory is based on the work of FORSYTHE (SIAM, 5 (1957) 74). POLFIT routine has the advantage that it is free from the problems associated with direct method of least squares. Restrictions of equal spacing or unit weights are avoided. Although this computer routine serves for general curve fitting purposes, it is developed to meet the requirements dedicated through the development of an integrated fuel cycle calculation scheme.

15233 (CONF-861070—Absts.) The 7th biennial CUBE [Computer Use By Engineers] symposium. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 173p. NTIS, PC A08. File Number DE87003890.

From 7. biennial Computer Use by Engineers (CUBE) symposium; Livermore, CA, USA (15 Oct 1986).

The purpose of the CUBE Symposium was to exchange information on computer hardware and software developments and applications among engineers and computer scientists at the Lawrence Livermore, Los Alamos, and Sandia National Laboratories. The CUBE Symposium benefits the participants and their respective Laboratories by providing a forum for: sharing information on recently developed and current computer codes for modeling physical processes; discussing solutions to a broad range of engineering problems both in weapons and in energy research programs; illustrating the development and effectiveness of computer methods for design, control, and experiment interpretation; describing creative approaches to the solution of engineering problems; and exploring trends in hardware/software and their impact on engineering. Abstracts of the presentations are given.

15234 (CONF-8610188—1) Interchange 1986 advanced OS/32 tutorial. Atkins, W.H. (Oak Ridge National Lab., TN (USA)). 2 Oct 1986. Contract AC05-84OR21400. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE87000751.

From Annual meeting of interchange computer user group; San Diego, CA, USA (2 Oct 1986).

Subroutines, tape service routines, and controls are described for the OS/32 I/O program. (WRF)

15235 (CTA-IEAV-NT—014/84) AMZ, library of multigroup constants for EXPANDA computer codes, generated by NJOY computer code from ENDF/B-IV. Chalhoub, E.S.; de Moraes, M. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1984. 51p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780499.

A 70-group, 37-isotope library of multigroup constants for fast reactor nuclear design calculations is described. Nuclear cross sections, transfer matrices, and self-shielding factors were generated with NJOY code and an auxiliary program RGENDF using evaluated data from ENDF/B-IV. The output is being issued in a format suitable for EXPANDA code. Comparisons with JFS-2 library, as well as test results for 14 CSEWG benchmark critical assemblies are presented.

15236 (EIR—570) Investigation of NJOY NMATXS-TRANSX-CTR-CELL code and MICROX-MICROX-2 routes to calculate moderated as well as fast systems using wet and dry PROTEUS buffer cell. Pelloni, S.; Koehler, P.; Stepanek, J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Sep 1985. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86780508.

The aim of this report is the comparison between two cell code systems which base on two different physical approaches. To this end wet and dry PROTEUS buffer cell reactivities are computed using the transport codes ONEDANT and SURCU together with self-shielded cross section ENDF/B-IV based libraries obtained using NMATXS module and postprocessor code TRANSX-CTR. TRANSX-CTR performs self-shielding of resonance cross sections using Bondarenko method. The same calculations are then repeated using new NJOY module MICROR and two region spectrum code MICROX-2, to perform more accurate pointwise resonance shielding solving slowing down equations. It is shown that the dry cell is not sensitive to the resonance cross sections, because the spectrum is too hard and energy of most neutrons is higher than resonance energies of fissionable isotopes. However, the lattice is sensitive to the fission spectrum used. Also the computations pertaining to the water moderated cell show sensitivity to different weighting functions used to calculate fission spectra from fission matrices, because the spectrum is still too hard. But now large differences in the reactivity of the cell arise between the shielding factor method and the computations based on the pointwise self-shielding. This is because the shielding factor method even if sophisticated (Bondarenko model) is not representative in lower resonance range where resonances are not narrow.

15237 (EPRI-EM—4896) A scoping study of intelligent databases: Potential applications of artificial intelligence techniques in a demand-side management database: Final report. Howard, H.C.; Pachavis, N.L.; Talukdar, S.N.; Fenves, S.J.; Rehak, D.R. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Engineering Design Research Center; Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1986. 58p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI87920170.

Aggregate databases of demand-side management (DSM) information are approaching a third stage of evolution. The first readily-available compilations of DSM information were in printed form. In the second (and current) stage of the development of DSM databases, the techniques of conventional database management systems (DBMSs) are being used to provide on-line reference databases. With the development of artificial intelligence (AI) techniques for information retrieval and extraction, it is now becoming possible to construct intelligent databases of DSM information. This

report examines the available artificial intelligence techniques in the areas of database management and information retrieval for their applicability to the development of an intelligent information center for demand-side management. 53 refs., 3 figs.

15238 **(FVI—5-14) Second machine class 2: An encyclopedic view of the parallel computation thesis.** Vanemdeboas, P. (Amsterdam Univ. (Netherlands)). Dec 1985. 27p. (ETN—86-98070; CONF-8509352—1). NTIS, PC A03/MF A01.

From 26. Stefan Banach International Mathematical Center semester on mathematical problems in computation theory; Warsaw, Poland (14 Sep 1985).

The parallel computation thesis, which states that polynomial time on a parallel machine equals polynomial space on a sequential device is discussed. This thesis is not an absolute truth for parallel models. It characterizes a specific, frequently observed species of parallelism. The thesis is illustrated by explaining why it holds for a number of models, and by presenting models for which the thesis is likely to fail.

15239 **(IC—85/114) A fourth order finite difference method for solving elliptic partial differential equations.** Shayo, L.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780076.

A fourth order finite difference method for solving second order elliptic partial differential equations with Dirichlet boundary conditions on a rectangle is developed. The simplicity of the standard 5-POINT STAR finite difference method (which is second order accurate) in two dimensions is retained. Four problems with known exact solutions are used to test the method and it is demonstrated that, for smooth problems, the method is indeed fourth order accurate. 1 ref., 1 fig., 4 tabs. (auth)

15240 **(IC—85/207) A note of Tchebichef's differential operators and their application to linear differential equations.** Onyango-Otieno, V.P. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE87780077.

The purpose of this note is to extend the idea of ascending and descending operators, developed by I.I. Chen and T.W. Barret for the Legendre operators, to the case of Tchebichef differential operators of first and second kind. Both kinds of operators are shown to be non-commutative. Applications of these operators are also discussed. 2 refs. (auth)

15241 **(IS—4909) New opportunities for productivity improvement in VAX/VMS V4 EDT editor.** Nieland, M.E.; Haas, W.J. Jr. (Ames Lab., IA (USA)). Sep 1986. Contract W-7405-ENG-82. 31p. NTIS, PC A03/MF A01. File Number DE87004549.

Some of the new features of the EDT editor distributed with VAX/VMS Version 4 are discussed. Fully annotated examples of new software modules that employ new information concerning the EDT utility routines to provide convenient support for user generation of subprocesses from within the EDT context are given. It is shown that such modules can be used to provide convenient user access to the VAX/VMS HELP facility and to a variety of HELP libraries while using EDT. Examples of the HELP libraries that can be conveniently accessed by using key sequences defined in an EDT startup command file given in this paper include DCL, FORTRAN, and other language HELP libraries, and even locally generated HELP libraries, such as a help library concerning the definitions of key sequences and macros by an EDT startup command file. 4 refs.

15242 **(K/CSD/TM—61) HEATING6 verification.** Bryan, C.B.; Childs, K.W.; Giles, G.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Dec 1986. Contract AC05-84OT21400. 169p. NTIS, PC E08/MF $6.50; 4. File Number DE87004779.

The HEATING series of general purpose, finite-difference, conduction heat transfer codes have been in use for many years. During this time the codes have been used extensively, and a general confidence has been developed in regard to their accuracy. However, there has never been a formal verification in a published, citable document. This report documents just such a verification study for the latest code in the HEATING series, HEATING6. This study confirms that HEATING6 is capable of producing accurate results for a large class of heat transfer problems. 11 refs., 170 figs., 82 tabs.

15243 **(LBL—22446) The statistical analysis of density equalized map projections.** Schulman, J. (California Univ., Berkeley (USA)). 6 Nov 1986. Contract AC03-76SF00098. 238p. NTIS, PC A11/MF A01. File Number DE87004596.

When cases of disease are plotted on a geopolitical map two problems arise. First, interpretation is difficult because large, sparsely populated areas dominate visually overshadowing small, densely populated areas. Second, analysis is difficult because the geographic subunits have different populations at risk. A demographic based map addresses both of these problems by transforming the geopolitical area to be proportional to the population. These transformed maps, called Density Equalized Map Projections (DEMPs), require the area of each subunit to be proportional to its population creating an equal population density for the entire area under study. This work develops techniques for the statistical analysis of data plotted on a DEMP. 53 refs., 68 figs., 39 tabs.

15244 **(N—87-10719) Dynamic remapping decisions in multi-phase parallel computations. Final report.** Nicol, D.M.; Reynolds, P.F.,JR. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Sep 1986. 48p. (NASA-CR—178174; NAS—1.26:178174; ICASE—86-58). NTIS, PC A03/MF A01.

The effectiveness of any given mapping of workload to processors in a parallel system is dependent on the stochastic behavior of the workload. Program behavior is often characterized by a sequence of phases, with phase changes occurring unpredictably. During a phase, the behavior is fairly stable, but may become quite different during the next phase. Thus a workload assignment generated for one phase may hinder performance during the next phase. We consider the problem of deciding whether to remap a paralled computation in the face of uncertainty in remapping's utility. Fundamentally, it is necessary to balance the expected remapping performance gain against the delay cost of remapping. This paper treats this problem formally by constructing a probabilistic model of a computation with at most two phases. We use stochastic dynamic programming to show that the remapping decision policy which minimizes the expected running time of the computation has an extremely simple structure: the optimal decision at any step is followed by comparing the probability of remapping gain against a threshold. This theoretical result stresses the importance of detecting a phase change, and assessing the possibility of gain from remapping. We also empirically study the sensitivity of optimal performance to imprecise decision threshold. Under a wide range of model parameter values, we find nearly optimal performance if remapping is chosen simply when the gain probability is high. These results strongly suggest that except in extreme cases, the remapping decision problem is essentially that of dynamically determining whether gain can be achieved by remapping after a phase change; precise quantification of the decision model parameters is not necessary.

15245 **(N—87-10743) Novel parallel architectures and algorithms for linear algebra processing. Semiannual report.** Casasent, D. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Oct 1986. 12p. (NASA-CR—179826; NAS—1.26:179826). NTIS, PC A02/MF A01.

Advanced problems in computational fluid dynamics, finite element structural analysis, and related areas require the solution of large partial differential equations and matrices of large size and dynamic range. This project considers an advanced parallel linear algebra processor and associated novel parallel algorithms for such applications. Research on system fabrication, quantitative performance evaluation and new parallel algorithms are described and considered. Case studies in structural mechanics, dynamics and nonlinear systems, finite element methods, computational fluid dynamics, and partial differential equations are included. The novel utilization

of an optical processor for the processing of such problems is the major research given attention.

15246 **(N—87-11495) Array processor with emulator (APE) project: a computer for lattice QCD.** Bacilieri, P.; Cabibbo, N.; Marinari, E.; Parisi, G.; Costantini, F.; Fiorentini, G.; Galeotti, S.; Passuello, D.; Tripiccione, R.; Fucci, A. (Rome Univ. (Italy)). Dec 1984. 17p. (NOTA-INTERNA—839; ETN—86-97936). NTIS, PC A02/MF A01.

A single instruction multiple data computer for studying lattice QCD is proposed. Although it can be used as a general purpose array processor controlled by the 3081/E, the hardware is optimized for lattice QCD. The theoretical speed is 1 Giga-Flop, i.e., 6 or 7 times faster than the Cray 1, and the memory can be expanded up to 0.5 Giga-byte.

15247 **(N—87-11511) Parallel processors and nonlinear structural dynamics algorithms and software. Final Technical report, 1 March-30 October 1986.** Belytschko, T. (Northwestern Univ., Evanston, IL (USA)). Nov 1986. 35p. (NASA-CR—179889; NAS—1.26:179889). NTIS, PC A03/MF A01.

A nonlinear structural dynamics program with an element library that exploits parallel processing is under development. The aim is to exploit scheduling-allocation so that parallel processing and vectorization can effectively be treated in a general purpose program. As a byproduct an automatic scheme for assigning time steps was devised. A rudimentary form of the program is complete and has been tested; it shows substantial advantage can be taken of parallelism. In addition, a stability proof for the subcycling algorithm has been developed.

15248 **(ORNL—6328) Bayesian variable selection in regression.** Mitchell, T.J.; Beauchamp, J.J. (Oak Ridge National Lab., TN (USA)). Jan 1987. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87005295.

This paper is concerned with the selection of subsets of "predictor" variables in a linear regression model for the prediction of a "dependent" variable. We take a Bayesian approach and assign a probability distribution to the dependent variable through a specification of prior distributions for the unknown parameters in the regression model. The appropriate posterior probabilities are derived for each submodel and methods are proposed for evaluating the family of prior distributions. Examples are given that show the application of the Bayesian methodology. 23 refs., 3 figs.

15249 **(ORNL/CSD/TM—238) Validation of KENO V.a: Comparison with critical experiments.** Jordan, W.C.; Landers, N.F.; Petrie, L.M. (Oak Ridge National Lab., TN (USA)). Dec 1986. Contract AC05-84OR21400. 348p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE87004023.

Section 1 of this report documents the validation of KENO V.a against 258 critical experiments. Experiments considered were primarily high or low enriched uranium systems. The results indicate that the KENO V.a Monte Carlo Criticality Program accurately calculates a broad range of critical experiments. A substantial number of the calculations showed a positive or negative bias in excess of 1 1/2% in k-effective (k/sub eff/). Classes of criticals which show a bias include 3% enriched green blocks, highly enriched uranyl fluoride slab arrays, and highly enriched uranyl nitrate arrays. If these biases are properly taken into account, the KENO V.a code can be used with confidence for the design and criticality safety analysis of uranium-containing systems. Sections 2 of this report documents the results of investigation into the cause of the bias observed in Sect. 1. The results of this study indicate that the bias seen in Sect. 1 is caused by code bias, cross-section bias, reporting bias, and modeling bias. There is evidence that many of the experiments used in this validation and in previous validations are not adequately documented. The uncertainty in the experimental parameters overshadows bias caused by the code and cross sections and prohibits code validation to better than about 1% in k/sub eff/. 48 refs., 19 figs., 19 tabs.

15250 **(ORNL/TM—10260) Solution of sparse positive definite systems on a shared-memory multiprocessor.** George, A.; Heath, M.T.; Liu, J.; Ng, E. (Oak Ridge National Lab., TN (USA)). Jan 1987. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01. File Number DE87005287.

Algorithms and software for performing sparse Cholesky decomposition and using the Cholesky factors in the solution of sparse symmetric positive definite systems on serial computers have reached a high state of development. In this paper we present algorithms for performing these two phases on a shared-memory multiprocessor computer, along with some numerical experiments demonstrating their performance on a Sequent Balance 8000 system. 10 refs., 3 figs., 7 tabs.

15251 **(REPT—5-46) Note on waiting times in systems with queues in parallel.** Blanc, J.P.C. (Technische Hogeschool Delft (Netherlands)). 1985. 13p. (ETN—86-98476). NTIS, PC A02/MF A01.

Numerical data concerning the mean and variance of the waiting time distribution for systems with queues in parallel, in which customers choose the shortest queue upon arrival are presented. A numerical method for calculating state probabilities and moments of queue length distributions is outlined. The method is based on power series expansions and recursion. It is applicable to systems with more than one waiting line. Numerical data concerning the mean and variance of the waiting time distribution for systems with queues in parallel, in which customers choose the shortest queue upon arrival are presented. A numerical method for calculating state probabilities and moments of queue length distributions is outlined. The method is based on power series expansions and recursion. It is applicable to systems with more than one waiting line.

15252 **(SAND—86-1472) The Id expert system environment.** Christiansen, A.D. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1987. Contract AC04-76DP00789. 52p. NTIS, PC A04/MF A01. File Number DE87004442.

The Id expert system development environment provides a forward-chaining rule interpreter and a rule language to facilitate the construction of expert systems. This new code provides a flexible and extendable representation of knowledge that allows small expert systems to be built quickly and easily. Id allows the creation of very readable knowledge bases with English-like rules, and may be easily transported to a wide variety of computers and operating systems.

15253 **(SAND—86-1753) 1986 ODE conference.** Watts, H.A. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1986. Contract AC04-76DP00789. 71p. (CONF-860759—Absts.). NTIS, PC A04. File Number DE87002196.

From Ordinary Differential Equations (ODE) conference; Albuquerque, NM, USA (28 Jul 1986).

Abstracts of a series of meetings on the numerical solution of initial value problems for ODEs and a series on boundary value problems are presented. (WRF)

15254 **(SAND—86-8246) A Fortran computer code package for the evaluation of gas-phase, multicomponent transport properties.** Kee, R.J.; Dixon-Lewis, G.; Warnatz, J.; Coltrin, M.E.; Miller, J.A. (Sandia National Labs., Livermore, CA (USA)). Dec 1986. Contract AC04-76DR00789. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE87004230.

This report documents a Fortran computer code package that is used for the evaluation of gas-phase multicomponent viscosities, thermal conductivities, diffusion coefficients, and thermal diffusion coefficients. The package is in two parts. The first is a preprocessor that computes polynomial fits to the temperature dependent parts of the pure species viscosities and binary diffusion coefficients. The coefficients of these fits are passed to a library of subroutines via a linking file. Then, any subroutine from this library may be called to return either pure species properties or multicomponent gas mixture properties. This package uses the chemical kinetics package CHEMKIN, and transport property subroutines are designed to be used in conjunction with the CHEMKIN subroutine library. This package supersedes a previously-written transport

property code package in which we used certain mixture averaging rules to compute mixture properties rather than the full multicomponent formulation.

15255 (UCID—20947) Approximation and data fitting methods: Part 1, Introduction to numerical approximation methods. Fritsch, F.N. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. 182p. NTIS, PC A09/MF A01. File Number DE87004451.

After a general statement of the numerical approximation problem and a discussion of the existence and uniqueness of best approximations, these notes treat polynomial interpolation, piecewise polynomial interpolation (including shape preserving methods and B-splines), parametric interpolation, multivariate interpolation, and functional approximation (including uniform and least squares approximation by polynomials). 4 refs.

15256 (UCRL—95614) Design and implementation of an efficient finite-difference, time-domain computer code for large problems. White, W.T. III; Taflove, A.; Stringer, J.C.; Kluge, R.F. (Lawrence Livermore National Lab., CA (USA); Northwestern Univ., Evanston, IL (USA); Stringer (James C.), Austin, TX (USA)). Dec 1986. Contract W-7405-ENG-48. 9p. (CONF-861240—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE87004354.

From 3. national conference on high power microwave technology for defense applications; Albuquerque, NM, USA (1 Dec 1986).

As computers get larger and faster, demands upon electromagnetics codes increase. Ever larger volumes of space must be represented with increasingly more accuracy and detail. This requires continually more efficient EM codes. To meet present and future needs in DOE and DOD, we are developing FDTD3D, a three-dimensional finite-difference, time-domain EM solver. When complete, the code will efficiently solve problems with tens of millions of unknowns. It already operates faster than any other 3D, time-domain EM code, and we are using it to model linear coupling to a generic missile section. At Lawrence Livermore National Laboratory (LLNL), we anticipate the ultimate need for such a code if we are to model EM threats to objects such as airplanes or missiles. This article describes the design and implementation of FDTD3D. The first section, "Design of FDTD3D," contains a brief summary of other 3D time-domain EM codes at LLNL followed by a description of the efficiency of FDTD3D. The second section, "Implementation of FDTD3D," discusses recent work and future plans.

15257 Optimistic partitioned operation in distributed data base systems. Ma, A.V. Urbana, IL; Univ. of Illinois (1986). 147p. University Microfilms Order No. 86-23,361.

Thesis (Ph. D.).

Network partitioning is a serious threat to the availability of replicated data in distributed database systems. To provide high data availability during partitioning, an optimistic strategy for transaction processing will allow transactions to be processed in any partition. Conflict detection and resolution will then be performed when partitions are merged. Recently, an automatic conflict detection and resolution methods based on serialization graphs was proposed in the literature. It has been argued that the graph theoretic method can be attractive for certain applications. In this thesis, several problems elated to the design and implementation of fault-tolerant transaction processing mechanisms that employ the graph-theoretic method are studied. A framework for the detection and synchronization of failures and recoveries is proposed. A major component of the framework is a new partition management protocol designed especially for optimistic partitioned operation. Several crash/merge recovery algorithms are developed and their implementation issues are discussed. This thesis also presents a simple validation algorithm that may be suitable for environments where transaction conflicts are rare.

15258 Parallel algorithms. Anderson, J.W. (Computer User Services, Los Alamos National Lab., Los Alamos, NM). pp 1 of Proceedings of the eighteenth Hawaii international conference on system sciences. Volume 2. Shriver, B.D. Honolulu, HI; Hawaii International Conference on System Sciences (1985). (CONF-850131—).

From International conference on systems science; Honolulu, HI, USA (1 Jan 1985).

For the past several years research into the understanding and development of parallel algorithms has been steadily increasing. This has been mandated by the increasing number of computer systems having parallel organizations. There now exist several multiprocessor systems that were constructed by linking microprocessors together in various topological configurations. The interest in these systems is due to their potential power for specific applications and the fact that they are relatively inexpensive. Manufacturers interested in producing high performance systems have developed, and are developing, systems with various parallel architectures or parallel capabilities. These include systems with vector processing, array processing, or either tightly or loosely coupled multiprocessor systems. The processors of multiprocessor systems can, themselves, have parallel organizations. For example, the processors of the Cray X-MP have vector processing capabilities. Having so many different architectural organizations leads to complications when considering parallel algorithms. An algorithm that is well matched to one system might not be suited at all for another. For example, when developing an algorithm, the granularity of the parallelism supported by the hardware must be considered. A vector processor is suited to problems with very fine granularity, whereas a mulitprocessor system with no vector processing capability is not. Because of this, parallel algorithm research, in some instances, has been partitioned into two basic classes, that for SIMD systems and that for MIMD systems.

15259 Buffering for vector performance on a pipelined MIMD machine. Sorensen, D.C. (Argonne National Lab., IL). *Parallel Computing;* 1: No. 2, 143-164(Dec 1984). Contract W-31-109-ENG-38.

A technique is presented for obtaining vector performance from a pipelined MIMD computer that does not have hardwired vector instructions. The specific computer in mind is the Denelcor HEP, but the technique might influence the use and possibly even the design of future machines with this type of architecture. This preliminary report presents the basic idea and demonstrates that it can be implemented. Buffering blocks of data to registers is used in conjunction with pipelined floating-point operations to achieve vector performance. Empirical evidence is presented to show that up to 5.8 megaflop performance is possible from the Denelcor HEP on very regular tasks such as matrix vector products. While this rate is not in the super-computer range, it is certainly respectable given the hardware capabilities of the HEP (this machine is rated at 10 MIPS peak). This performance indicates that an apparently minor refinement to the architectural design could provide very efficient vector operations in addition to the parallelism and low-overhead synchronization already offered by the HEP architecture. 7 references, 2 figures, 1 table.

15260 Vectorizing and machine-spanning techniques. Giroux, E.D. (Lawrence Livermore National Lab., CA). pp 303-309 of Parallel computing 83. Feilmeier M.; Joubert, J.; Schendel, U. (eds.). Amsterdam, Netherlands; Elsevier Science Publishers B.V. (1984). Contract W-7405-ENG-48.

Techniques for vectorizing complex logic are shown using a decoupled sliding-surface calculation that is part of a two-dimensional Lagrangian simulation model. The same source coding can be run on many vector, parallel, and multiprocessor computers with little or no alteration. The vectorizing techniques have been used for a wide range of problems. 3 references, 9 figures.

15261 Proposed radix- and word-length-independent standard for floating-point arithmetic. Cody, W.J.; Coonen, J.T.; Gay, D.M.; Hanson, K.; Hough, D.; Kahan, W.; Karpinski, R.; Palmer, J.; Ris, F.N.; Stevenson, D. (Argonne National Lab., IL). *IEEE Micro;* 86-100(1984). Contract W-31-109-ENG-38.

The Microprocessor Standards Committee of the IEEE Computer Society sponsors two groups drafting proposed standards for floating-point arithmetic. The first, Task P754, reported Draft 10.0 of a Proposed Standard for Binary Floating-point Arithmetic out of committee in December, 1982. The document is now a de facto standard and is progressing slowly through the approval process within the IEEE Computer Society. In August 1983, the

second group, Task P854, completed Draft 1.0 of a Proposed Radix- and Word-length independent Standard for Floating-point Arithmetic that generalizes and is upward compatible with the IEEE Proposed Standard for Binary Floating-point Arithmetic. This article places their contents before the public for the first time. 10 references, 3 tables.

9903 Information Handling

REFER ALSO TO CITATION(S) 13574, 13921, 15145, 15226, 15229, 15257

15262 **(AD-A—174008/3/XAB) Computer-aided design for the generation of test transactions and test data bases and for the benchmarking of parallel, multiple-backend data base systems. Master's thesis.** Fenton, G.P. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1986. 134p. NTIS, PC A07/MF A01.

The multi-backend data-base system (MBDS) is a research effort conducted jointly by the Naval Postgraduate School and Ohio State University with the sponsorship of the STARS foundation. The MBDS is designed to overcome the capacity growth and performance gain problems of the traditional data-base systems and the single-backend data-base systems. To verify the capacity growth and performance claims, a benchmarking methodology was formulated in the Naval Postgraduate thesis, A Performance Measurement Methodology for Software Multiple-Backend Database Systems by James R. Vincent. This thesis presents the implementation of the methodology in the form of a computer-aided design system for the generation of test data-bases and test-transaction mixes for benchmarking MBDS.

15263 **(AD-A—174548/8/XAB) Fabrication of material and devices for very-high-density information storage. Report No. 1 (Final) January-December 1985.** Kryder, M.H.; Thuel; Bowman; Huang. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Electrical and Computer Engineering). 24 Nov 1986. 15p. NTIS, PC A02/MF A01.

An ion-beam-deposition system was purchased and utilized for research on magnetic materials and devices for high-density magnetic information storage. Initial work was carried out on the deposition of permalloy and the deposition of magnetic oxides. The work on permalloy revealed that ion-beam deposited materials generally had smaller grain size and lower coercivity than R.F. sputtered materials. This work is being continued with support from other sources. The work on magnetic oxides was begun with the deposition of cobalt ferrite. X-ray-diffraction measurements indicate the material deposited was amorphous and exhibited a hard axis of anisotropy perpendicular to the plane of the film. This work is also being continued with support from other sources.

15264 **(INIS-mf—10099) Problems in decentralized data acquisition.** Eder, R. (International Atomic Energy Agency, Vienna (Austria)). Apr 1985. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780530.

This paper describes INIS (International Nuclear Information System) which is operated by the International Atomic Energy Agency (IAEA) in collaboration with 73 Member States and 14 international organizations. INIS is a computerized system for collecting, processing and disseminating nuclear information. The collection and scanning of literature, input preparation and the dissemination of output are completely decentralized, the checking and merging of the information data are centralized. This paper shows the structure, management, processing and problem areas of this system.

15265 **(MLM-MU—87-61-0022) Mound end user information: Handling requirements.** Eimutis, E.C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 30 Jan 1987. Contract AC04-76DP00053. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE87004637.

The acquisition of a mainframe computer system, the end user computer (EUC), was approved by the Department of Energy (DOE). This computer will support the unclassified information-handling needs of the end user community. The selection of the information processing capabilities for this system is being managed through the efforts of three groups: Needs Assessment Group (NAG), an End User Group (EUG), and a Software Selection Group (SSG). This report documents the results of the EUG activities. Data retrieval, presentation graphics, financial management, project management, and information exchange were identified as required information-handling services by over half of the 55 functional groups surveyed at Mound.

CORPORATE AUTHOR INDEX

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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

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Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
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	12:13398	SERI/STR—254-3058
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AC02-83CH10140	**Telegraph Exploration, Inc., TX (USA)**	
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AC02-83ER13048	**Westinghouse Research and Development Center, Pittsburgh, PA (USA)**	
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AC02-83ER40114	**Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Physics**	
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AC02-83ER53164	**Colorado Univ., Boulder (USA)**	
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AC02-84ER13158	**Syracuse Univ., NY (USA). Dept. of Chemical Engineering and Materials Science**	
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AC02-84ER13163	**SKF Industries, Inc., King of Prussia, PA (USA). SFK Tribonetics**	
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AC02-85MA00194	**Battelle Columbus Div., OH (USA)**	
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AC02-86ER40257	**Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science**	
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AC03-76SF00098	**Lawrence Berkeley Lab., CA**	
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AC03-84ER51044	**GA Technologies, Inc., San Diego, CA (USA)**	
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AC03-84SF12196	**Utah Univ. Research Inst., Salt Lake City (USA). Earth Sciences Lab.**	
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AC04-76DP00053	**Monsanto Research Corp., Miamisburg, OH (USA). Mound**	
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AC04-76DP00613	**Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.**	
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AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
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	12:14180	SAND—86-2617
	12:14183	SAND—86-1702
	12:15131	SAND—86-1685C
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AC04-76DR00789	**Sandia National Labs., Livermore, CA (USA)**	
	12:15254	SAND—86-8246
AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (USA)**	
	12:13145	GRI—86/0127
	12:13203	DOE/OR/00033—T265
	12:13638	DOE/OR/00033—T260
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AC05-84OR21400	**Argonne National Lab., IL (USA)**	
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	Oak Ridge National Lab., TN (USA)	
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AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
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AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
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AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
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	12:13507	HEDL-SA—3381-FP
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	12:13512	HEDL-SA—3508-FP
	12:13533	HEDL-SA—3390
	12:13534	HEDL-SA—3469-FP
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AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
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AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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AC08-83NV10282	**EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations**	
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AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant**	
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AC09-76SR00819	**Univ. of Georgia, Aiken, SC**	
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AC21-82MC20229	Solar Turbines, Inc., San Diego, CA (USA)	
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AC21-83MC20342	Institute of Gas Technology, Chicago, IL (USA)	
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AC21-84MC21175	Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering	
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AC21-84MC21186	Energy Research Corp., Danbury, CT (USA)	
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AC22-84BC99880	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	12:13187	DOE/BC/99880—15
AC22-84PC70042	Lummus Crest, Inc., Bloomfield, NJ (USA)	
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AC22-85PC81208	Atlantic Research Corp., Alexandria, VA (USA)	
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AC22-85PC81210	Michigan Technological Univ., Houghton (USA). Inst. of Materials Processing	
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AC22-86PC91021	Florida State Univ., Tallahassee (USA). Dept. of Physics	
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AI01-79CS30078	Naval Weapons Center, China Lake, CA (USA)	
	12:13375	DOE/CS/30078—T1
AI01-85CE50112	Sverdrup Technology, Middleburg Heights, OH (USA)	
	12:13727	DOE/NASA/50112—68
AI03-84SF12208	Lawrence Livermore National Lab., CA (USA)	
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AI05-82OR21005	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
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AS03-76ER72018	Stanford Univ., CA (USA). Systems Optimization Lab.	
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AS05-81ER40030	Texas Univ., Austin (USA). Dept. of Physics	
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AS05-82ER12022	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	
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AS05-82ER13015	Univ. of Maryland, College Park	
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FC01-84CE40699	University City Science Center, Philadelphia, PA (USA). Center for Energy Management and Industrial Technology	
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FC21-83FE60177	Western Research Inst., Laramie, WY (USA)	
	12:13221	DOE/FE/60177—2245
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FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	12:13164	NIPER—146
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FC22-85PC80009	Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research	
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FG01-85CE90234	Dayton Univ., OH (USA). Research Inst.	
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FG01-86CE15295	Pneumatic Turbine Partnership, Santa Fe, NM (USA)	
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FG01-86CE63474	Redwood Community Action Agency, Eureka, CA (USA)	
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FG01-86CE63477	ACTION-Housing, Inc., Pittsburgh, PA (USA)	
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FG02-84ER45161	Pennsylvania Univ., Philadelphia (USA). Dept. of Materials Science	
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FG02-84ER60215	Indiana Univ., Bloomington	
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85-0028	*See* AD-A-173658/6/XAB			12:14567
85-0030	*See* AD-A-173958/0/XAB			12:14573
85-0031	*See* AD-A-173742/8/XAB			12:14568
85-0032	*See* AD-A-173765/9/XAB			12:14570
85-0318	*See* AD-A-173680/0/XAB			12:14179
86-0189	*See* AD-A-173822/8/XAB			12:14571
86-0229	*See* AD-A-174216/2/XAB			12:14576
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AFIT/GNE/ENP-				
86M-6	*See* AD-A-174153/7/XAB			12:13973
AFWL-TN-				
85-46	*See* AD-A-173725/3/XAB			12:13951

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86-12	*See* AD-A-173097/7/XAB				12:14163
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87-0517	*See* SAND-86-1574C		DE87004312	MN -38	12:13938
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86-40	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003297	STD -94cb	12:13562
7416-Suppl.3	NTIS PC E13/MF $6.35; 3 (GPO Dep.)	E 1.99:	DE86012678	STD -32	12:13497
ANL/EES-TM-					
316	NTIS PC E08/MF $5.70; 1 (GPO Dep.)	E 1.99:	DE87004445	MN -70	12:13259
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86-4	NTIS, PC A05/MF A01; 1		DE87004556	STD -90	12:14166
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87-1	NTIS, PC A17/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004635	STD -20	12:15159
ANL-HEP-CP-					
86-124	NTIS, PC A02; 3		DE87004969	MN -34D	12:14623
ANU-P-					
935	NTIS (US Sales Only), PC A02/MF A01		DE86780485	MN -28	12:14047
936	NTIS (US Sales Only), PC A02/MF A01		DE86780486	MN -25	12:13743
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271	NTIS (US Sales Only), PC A03/MF A01		DE86780487	MN -80	12:13501
274	NTIS (US Sales Only), PC A02/MF A01		DE86780488	MN -80	12:13502
276	NTIS (US Sales Only), PC A02/MF A01		DE86780560	MN -83	12:15232
277	NTIS (US Sales Only), PC A03/MF A01		DE86780490	MN -79	12:13498
278	NTIS (US Sales Only), PC A03/MF A01		DE86780491	MN -34C	12:14092
280	NTIS (US Sales Only), PC A06/MF A01		DE86780492	MN -23	12:14416
281	NTIS (US Sales Only), PC A02/MF A01		DE86780493	MN -34C	12:14093
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84-35	*See* PB-87-121307/XAB				12:13185
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071	NTIS, PC A08/MF A01				12:13355
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1905	*See* NUREG/CR-4567		TI87900169	MN -80	12:13542
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613-3638	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004554	STD -25	12:14009
613-3642	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004557	STD -25	12:13812
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197	*See* AD-A-173894/7/XAB				12:13173
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15027	NTIS (US Sales Only), MF A01; 2		DE87900420	MN -95d	12:13656
15034	NTIS (US Sales Only), MF A01; 2		DE87900423	MN -38	12:13942
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86-089	NTIS (US Sales Only), PC A09/MF A01; 1		DE87751156	MN -95d	12:13698
86-091	NTIS (US Sales Only), PC A05/MF A01; 1		DE87751155	MN -63	12:13356
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1000	NTIS, PC A07/MF A01; 2		DE87004904	MN -25	12:13744
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621-Vol.1	NTIS, PC A04/MF A01; 1		DE87004783	STD -70	12:13141
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627	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87005209	STD -70	12:13260
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31381-R2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87003784	MN -11	12:14229
38690	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87001471	MN -34C	12:15115
38777	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004604	MN -63c	12:13357
38786	NTIS, PC A03/MF A01; 1		DE87002393	MN -34	12:14506
38797	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004173	MN -98	12:13604
38815	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002586	MN -48	12:13358
38852	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003488	MN -28	12:14067
38854	NTIS, PC A02; 3		DE87003473	MN -28	12:14068
38855	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003474	MN -28	12:14069
38857	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003475	MN -28	12:14059
38863	NTIS, PC A02; 3		DE87004172	MN -34B	12:14507
38868	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003481	MN -48	12:15107
38874	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE87002589	MN -13	12:13426
38909	NTIS, PC A02; 3		DE87003482	MN -34D	12:14662
38924	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003209	MN -25	12:15137
38965	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003478	MN -28	12:14060

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38966	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003486	MN -28	12:14070
38968	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003477	MN -28	12:14071
38974	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003487	MN -28	12:14061
38977	NTIS, PC A02/MF A01; 1		DE87003483	MN -28	12:14062
39001	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004174	MN -34A	12:14579
39003	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004067	MN -25	12:13745
39045	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004179	MN -28	12:14063
39047	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004177	MN -28	12:14064
39049	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004175	MN -34	12:13952
39073	NTIS, PC A02; 3		DE87003435	MN -25	12:13746
39074	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004180	MN -25	12:13747
39075	NTIS, PC A02; 3		DE87004181	MN -34	12:15116
39076	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004170	MN -34	12:13843
51959	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004151	STD -28	12:14072
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38836	NTIS, PC A02/MF A01 - GPO		TI87002587	MN -78	12:13519
39056	NTIS, PC A02/MF A01 - GPO		TI87004178	MN -78	12:13472
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86-313R	*See* AD-A-172996/1/XAB				12:13949
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2435	*See* AD-A-172655/3/XAB				12:14354
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8447	*See* AD-A-173884/8/XAB				12:13581
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025/ 85	NTIS (US Sales Only), PC A02/MF A01		DE86780494	MN -48	12:14410
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86-06	*See* N-87-10977				12:13829
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8262	NTIS (US Sales Only), PC A03/MF A01		DE87750765	MN -34C	12:14872
8438	NTIS (US Sales Only), PC A02/MF A01		DE87750776	MN -34D	12:14641
8448	NTIS (US Sales Only), PC A02/MF A01		DE87750708	MN -25	12:13813
8451	NTIS (US Sales Only), PC A02/MF A01		DE87750709	MN -34C	12:14794
8576	NTIS (US Sales Only), MF A01; 2		DE87751296	MN -25	12:13328
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86-051	*See* CEA-CONF-8438		DE87750776	MN -34D	12:14641
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85-15	NTIS (US Sales Only), PC A09/MF A01		DE86780495	MN -34D	12:14094
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003	NTIS (US Sales Only), PC A05/MF A01		DE86780496	MN -80	12:13459
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86-12	*See* AD-A-173961/4/XAB				12:15228
CONF-840619-	(31. annual meeting of the Society of Nuclear Medicine, Los Angeles, CA, USA, 5-8 Jun 1984)				
	J. Nucl. Med., 25: No. 5, 118(1984)				12:13911
	J. Nucl. Med., 25: No. 5, 120(1984)				12:13912
	J. Nucl. Med., 25: No. 5, 102(1984)				12:14155
CONF-8407190-	(Workshop on cosmogenic nuclides, Los Alamos, NM, USA, 26-27 Jul 1984)				
Absts.	*See* N-86-32348				12:14535
CONF-8409122-	(Quadrennial ozone symposium, Halkidiki, Greece, 3-7 Sep 1984)				
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002271	MN -11	12:14230
CONF-8410461-	(Turbine engine hot section technology conference, Cleveland, OH, USA, 23-24 Oct 1984)				
	See N-87-11180				12:14019
CONF-841250-	(International conference on engineering ceramics, Jerusalem, Israel, 16-21 Dec 1984)				
2	Elsevier Sequoia		TI87003340	ND -25	12:13799
CONF-8412120-	(Ad hoc consultants meeting on mechanisms of solid-liquid interaction and their simulation: applications of studies of mass transfer in aqueous environment, Vienna, Austria, 10-14 Dec 1984)				
	See IAEA-TECDOC-367		DE87701285	MN -4	12:13869
CONF-850415-	(4. international conference on wear of materials, Vancouver, Canada, 14-18 Apr 1985)				
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003341	MN -25	12:13800
CONF-850507-	(International conference on nuclear data for basic and applied science, Santa Fe, NM, USA, 13-17 May 1985)				
	Gordon and Breach, 50 West 23rd Street, New York, NY 10010				12:14700
CONF-8505100-	(7. symposium on the physics and technology of compact toroids in the magnetic fusion energy program, Santa Fe, NM, USA, 21-23 May 1985)				
	See LA-10830-C	E 1.99:	DE87003801	STD -20	12:15195
19	NTIS, PC A02/MF A01		DE87003366	MN -20a	12:15161

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CONF-8505207-	(Conference on perspectives in nonlinear dynamics, Washington, DC, USA, 28-30 May 1985)			
2-Pt.9	*See* DOE/ER/13147-2-Pt.9	DE87000765	MN -34	12:15140
CONF-850617-	(9. symposium on thermophysical properties, Boulder, CO, USA, 24-27 Jun 1985)			
	Int. J. Thermophys., 7: No. 4, 743-754(Jul 1986)			12:13297
	Int. J. Thermophys., 7: No. 4, 863-876(Jul 1986)			12:14616
	Int. J. Thermophys., 7: No. 4, 877-886(Jul 1986)			12:14617
	Int. J. Thermophys., 7: No. 2, 305-317(Mar 1986)			12:14618
	Int. J. Thermophys., 7: No. 2, 395-405(Mar 1986)			12:14619
CONF-8506104-	(26. Society of Professional Well Log Analysts annual logging symposium, Dallas, TX, USA, 17-20 Jun 1985)			
4	*See* ETN-6-97256			12:13144
CONF-8506110-	(Review of progress in quantitative NDE, Williamsburg, VA, USA, 23-28 Jun 1985)			
	New York, NY; Plenum Press (1986).			12:14008
CONF-8506326-	(Conference on swine in biomedical research, Columbia, MO, USA, 17-20 Jun 1985)			
	Plenum Publishing Corp., New York, N.Y.			12:14387
	Plenum Publishing Corp., New York, N.Y.			12:14388
CONF-8506329-	(Fossil plant water chemistry symposium, Atlanta, GA, USA, 11-13 Jun 1985)			
	See EPRI-CS-4950	TI87920148	ND -90	12:13438
CONF-8506330-	(Colloquium on structural mechanics, Brunswick, F.R. Germany, 19 Jun 1985, 19 Jun 1985)			
	See ESA-TT-50			12:13837
	See ESA-TT-50			12:13838
	See ESA-TT-50			12:13839
CONF-8506332-	(Conference on the history of particle physics, Dubna, USSR, 25-27 Jun 1985)			
	See JINR-R-2-85-667	DE87780075	MN -34	12:15148
1	*See* LBL-22392	E 1.99: DE87003546	MN -34D	12:14630
CONF-850771-	(SLAC summer school on the physics of high energy particle accelerators, Stanford, CA, USA, 15-26 Jul 1985)			
9	*See* BNL-38977	DE87003483	MN -28	12:14062
CONF-850809-	(8. international conference on structural mechanics in reactor technology, Brussels, Belgium, 19-23 Aug 1985)			
85	*See* SRD-R-358	TI87900229	ND -80	12:13549
CONF-850944-	(Muskoka conference: international symposium on acidic precipitation, Toronto, Ontario, Canada, 15-20 Sep 1985)			
	Water, Air, Soil Pollut., 30: No. 1-2, 319-330(Sep 1986)			12:14305
CONF-8509189-	(CERN FASTBUS software workshop, Geneva, Switzerland, 23-24 Sep 1985)			
	See CERN-85-15	DE86780495	MN -34D	12:14094
CONF-8509213-	(Frontiers of quantum Monte Carlo conference, Los Alamos, NM, USA, 3-6 Sep 1985)			
	J. Stat. Phys., 43: No. 5/6, 1043-1059(Jun 1986)			12:14677
	J. Stat. Phys., 43: No. 5/6, 1061-1072(Jun 1986)			12:14678
	J. Stat. Phys., 43: No. 5/6, 1101-1104(Jun 1986)			12:14679
	J. Stat. Phys., 43: No. 5/6, 1209-1237(Jun 1986)			12:15153
	J. Stat. Phys., 43: No. 5/6, 731-1244(Jun 1986)			12:15154
CONF-8509276-	(International symposium on particle and nuclear physics, Beijing, China, 2-7 Sep 1985)			
2	*See* EFI-86-19	E 1.99: DE87004576	MN -34D	12:14674
CONF-8509351-	(15. European microwave conference, Paris, France, 9-13 Sep 1985)			
1	*See* ISL-CO-28/85			12:13802
CONF-8509352-	(26. Stefan Banach International Mathematical Center semester on mathematical problems in computation theory, Warsaw, Poland, 14-16 Sep 1985)			
1	*See* FVI-5-14			12:15238
CONF-851056-	(Computer aided methods in radiation protection, Budapest, Hungary, 22-25 Oct 1985)			
Absts.	*See* INIS-mf-10100	DE86780531	MN -41	12:14424
CONF-8510357-	(Workshop on the construction and commissioning of dedicated synchrotron radiation facilities, Upton, NY, USA, 16-18 Oct 1985)			
	See BNL-51959	E 1.99: DE87004151	STD -28	12:14072
CONF-8510375-	(2. geology South Brazilian symposium, Florianopolis, Brazil, 1 Oct 1985)			
3	*See* INIS-BR-563	DE87701291	MN -4	12:14480
4	*See* INIS-BR-564	DE87701292	MN -51	12:14303
5	*See* INIS-BR-565	DE87701293	MN -4	12:14481
CONF-8510377-	(Spent nuclear fuel transportation workshop for state officials, Springfield, IL, USA, 22 Oct 1985)			
Summs.	NTIS, PC A03/MF A01; 1	DE87000042	MN -71	12:13250

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CONF-8510385-	(International conference on the assessment of the role of carbon dioxide and of other greenhouse gases in climate variations and associated impacts, Villach, Austria, 9-15 Oct 1985)			
	See WMO-61			12:14294
CONF-8510391-	(Session of Energieforum Schweiz, Bern, Switzerland, 3 Oct 1985, 3 Oct 1985)			
1	NTIS (US Sales Only), PC A02/MF A01; 1	DE87751157	MN -98	12:13611
CONF-8510394-	(1. colloquium on humus of the Deutsche Bodenkundliche Gesellschaft, Bayreuth, F.R. Germany, 29-30 Oct 1985)			
	NTIS (US Sales Only), PC A09/MF A01; 1	DE87751255	MN -11	12:14307
CONF-8510398-	(Seminar on power system planning and operations: voltage-volt-ampere-reactive (VAR) projects, Philadelphia, PA, USA, 8-10 Oct 1985)			
Summ.	*See* EPRI-EL-4863	TI87920120	ND -97c	12:13453
CONF-8510399-	(U.S. Department of Energy electric energy systems planning workshop: trends and research and development needs for the 1990s, Seattle, WA, USA, 23-25 Oct 1985)			
Summ.	*See* PNL-SA-14217	DE87004560	MN -97	12:13457
CONF-8511246-	(Discussion meeting of the Arbeitsgemeinschaft Fernwaerme e.V.: environmentally compatible heat generation - improving the economic efficiency of heat distribution systems, Hameln, F.R. Germany, 4-5 Nov 1985)			
	NTIS (US Sales Only), PC A16/MF A01; 1	DE87751252	MN -95	12:13599
CONF-8511251-	(Municipal solid waste as a utility fuel, Madison, WI, USA, 20-22 Nov 1985)			
	See EPRI-CS-4900-SR	E 1.99: DE87003411	MN -95e	12:13348
CONF-8511254-	(Symposium on mechanics for space flight, Tokyo, Japan, 7 Nov 1985, 7 Nov 1985)			
	See ISAS-SP-			12:13982
CONF-8511255-	(Goodard Space Flight Center battery workshop, Greenbelt, MD, USA, 19-21 Nov 1985)			
	See N-87-11072			12:13569
CONF-8511259-	(Boulder damage symposium, Boulder, CO, USA, 17-19 Nov 1985)			
1	NTIS, PC A02; 3	DE87004393	MN -25	12:13756
CONF-8512113-	(Round table meeting on chemical and physical valorization of coal, Brussels, Belgium, 12 Dec 1985, 12 Dec 1985)			
	See EUR-10588-DE-EN-FR			12:13045
CONF-860152-	(10. annual conference on composites and advanced ceramic materials, Cocoa Beach, FL, USA, 19-24 Jan 1986)			
	Ceram. Eng. Sci. Proc., 7: 1032-1038(Aug 1986)			12:13738
9	*See* N-86-31729			12:13805
CONF-860191-	(9. OAXTEPEC symposium on nuclear physics, Mexico City, Mexico, 2-5 Jan 1986)			
1	*See* CEA-CONF-8262	DE87750765	MN -34C	12:14872
CONF-860213-	(6. symposium on the transfer and utilization of particulate control technology, New Orleans, LA, USA, 25-28 Feb 1986)			
Vol.3	*See* EPRI-CS-4918-Vol.3	TI87920155	ND -90	12:13450
CONF-8602100-	(3. annual conference of VDI-Gesellschaft Energietechnik and special meetings, Darmstadt, F.R. Germany, 25-26 Feb 1986)			
Pt.1	NTIS (US Sales Only), PC A11/MF A01; 1	DE87751251	MN -90i	12:13086
CONF-8602110-	(Conference on polycyclic aromatic hydrocarbons and astrophysics, Les Houches, France, 1 Feb 1986, 1 Feb 1986)			
2	NTIS, PC A02/MF A01	DE87003376	MN -34B	12:14508
CONF-860304-	(Corrosion '86, Houston, TX, USA, 17-21 Mar 1986)			
11	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616	TI87900446	MN -93A	12:13628
CONF-860311-	(Nuclear power plant maintenance meeting, Salt Lake City, UT, USA, 23-27 Mar 1986)			
12	*See* HEDL-SA-3364-FP	E 1.99: DE87004092	MN -79k	12:13511
13	*See* HEDL-SA-3381-FP	E 1.99: DE87004088	MN -79	12:13507
CONF-860340-	(115. American Institute of Mining, Metallurgical and Petroleum Engineers annual meeting, New Orleans, LA, USA, 2-6 Mar 1986)			
12	*See* N-86-31699			12:13772
13	*See* N-86-31702			12:13773
14	*See* N-86-32557			12:13774
CONF-8603119-	(21. Rencontre de Moriond: strong interactions and gauge theories conference, Les Arcs, France, 16-22 Mar 1986)			
13	*See* CEA-CONF-8438	DE87750776	MN -34D	12:14641
CONF-860413-	(2. international symposium on ceramic materials and components for engines, Luebeck-Travemuende, F.R. Germany, 14-17 Apr 1986)			
4	*See* N-86-31912			12:14006

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CONF-860421-	(2. international conference on fusion reactor materials (ICFRM-2), Chicago, IL, USA, 13-17 Apr 1986)			
68	*See* HEDL-SA-3415-FP	E 1.99: DE87004342	MN -20c	12:13763
CONF-860425-	(191. American Chemical Society national meeting, New York, NY, USA, 13-18 Apr 1986)			
39	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87004954	MN -90a	12:13063
CONF-860482-	(Symposium on natural gas energy measurement, Chicago, IL, USA, 30 Apr-2 May 1986)			
1	Inst. of Gas Tech., 3424 South State Street, Chicago, IL 60616	TI87900449	MN -92	12:13212
CONF-8604116-	(International workshop on high temperature molten salt batteries, Argonne, IL, USA, 16-18 Apr 1986)			
	See ANL-86-40	E 1.99: DE87003297	STD -94cb	12:13562
CONF-8604156-	(Symposium on industrial combustion technologies, Chicago, IL, USA, 29-30 Apr 1986)			
	American Society for metals, Metals Park, OH 44073	TI87004152	ND -38	12:14016
CONF-8604218-	(American Gas Association: distribution/transmission conference, Chicago, IL, USA, 28-30 Apr 1986)			
2	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616	TI87900450	MN -92	12:13211
3	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616	TI87900442	MN -92	12:13202
4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003957	MN -61D	12:13334
5	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616	TI87900440	MN -11	12:13714
CONF-8604271-	(Meeting on order-disorder and point effects, Grenoble, France, 15-16 Apr 1986)			
1-Summ.	*See* CEA-CONF-8448	DE87750708	MN -25	12:13813
CONF-8604287-	(IMA status seminar biotic damaging factors/epidemiology, Stuttgart, F.R. Germany, 24-25 Apr 1986)			
Summs.	*See* Juel-Spez-364	DE87751176	MN -48	12:14461
CONF-8604290-	(Joint national meeting of ORSA/TIMS, Philadelphia, PA, USA, 4 Apr 1986, 4 Apr 1986)			
2	*See* PNL-SA-13866	DE87004466	MN -95d	12:13654
CONF-860506-	(International conference on heavy ion nuclear collisions in the Fermi energy domain, Caen, France, 12-16 May 1986)			
7-Summ.	*See* CEA-CONF-8451	DE87750709	MN -34C	12:14794
CONF-860540-	(169. meeting of the Electrochemical Society, Boston, MA, USA, 4-9 May 1986)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003771	MN -25	12:13748
9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003772	MN -25	12:13749
CONF-860567-	(SPE unconventional gas technology symposium, Louisville, KY, USA, 18-21 May 1986)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003950	MN -92	12:13196
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003949	MN -92	12:13197
CONF-860575-	(2. conference on particle and nuclear physics, Lake Louise, Canada, 26-31 May 1986)			
	American Institute of Physics, 335 E. 45th St., New York, NY 10017	TI87003436	ND -34C	12:14693
CONF-860583-	(International Committee for Future Accelerators workshop on superconducting magnets and cryogenics, Upton, NY, USA, 12-16 May 1986)			
2	*See* BNL-38968	E 1.99: DE87003477	MN -28	12:14071
3	*See* BNL-38965	E 1.99: DE87003478	MN -28	12:14060
4	*See* BNL-38966	E 1.99: DE87003486	MN -28	12:14070
5	*See* BNL-38974	E 1.99: DE87003487	MN -28	12:14061
CONF-860601-	(4. international conference on emerging nuclear energy systems, Madrid, Spain, 30 Jun-4 Jul 1986)			
12	*See* UCRL-94058	DE87003519	MN -20	12:15214
CONF-860605-	(13. international symposium on the effects of radiation on materials, Seattle, WA, USA, 23-25 Jun 1986)			
36	*See* HEDL-SA-3390	E 1.99: DE87004435	MN -78	12:13533
37	*See* HEDL-SA-3398-FP	E 1.99: DE87004350	MN -20c	12:13762
38	*See* HEDL-SA-3394	E 1.99: DE87004436	MN -78	12:13504
CONF-860621-	(OSA/IEEE international quantum electronics conference (IQEE '86), San Francisco, CA, USA, 9-13 Jun 1986)			
1	*See* DOE/ER/10979-14	E 1.99: DE87004307	MN -34	12:13953
CONF-860629-	(Linear accelerator conference, Stanford, CA, USA, 2-6 Jun 1986)			
66	*See* LBL-22554	E 1.99: DE87003548	MN -28	12:14053
67	*See* SLAC-PUB-3971	E 1.99: DE87004565	MN -28	12:14086
CONF-860674-	(17. power modulator symposium, Seattle, WA, USA, 23-25 Jun 1986)			
11	*See* LBL-21758	E 1.99: DE87003547	MN -28	12:14082
CONF-8606160-	(3. international workshop on solar thermal central receiver systems, Konstanz, F.R. Germany, 23-27 Jun 1986)			
3	*See* SERI/TP-252-2964	E 1.99: DE87001132	MN -62a	12:13390

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CONF-8606168-	(NATO workshop on chemistry and physics of fracture, Bad Reichenhall, F.R. Germany, 22 Jun-1 Jul 1986)				
3	*See* CEA-CONF-8576		DE87751296	MN -25	12:13328
CONF-8606173-	(1. symposium on computational chemistry on Cray supercomputers, Minneapolis, MN, USA, 11-13 Jun 1986)				
2	*See* LBL-22011		DE87003543	MN -34A	12:14599
CONF-8606202-	(CRDEC conference on obscuration and aerosol research, Aberdeen, MD, USA, 23-27 Jun 1986)				
5	*See* PNL-SA-14364		DE87004464	MN -25	12:13831
CONF-8606204-	(International Astronomical Union colloquium, Bamberg, F.R. Germany, 16-19 Jun 1986)				
2	*See* BNL-38863		DE87004172	MN -34B	12:14507
CONF-8606215-	(Summer study on the physics of the superconducting super collider, Snowmass, CO, USA, 23 Jun-11 Jul 1986)				
24	*See* BNL-39047	E 1.99:	DE87004177	MN -28	12:14064
25	*See* BNL-39045	E 1.99:	DE87004179	MN -28	12:14063
26	*See* BNL-38857	E 1.99:	DE87003475	MN -28	12:14059
27	*See* BNL-38909		DE87003482	MN -34D	12:14662
29	*See* LBL-22497	E 1.99:	DE87004591	MN -34D	12:14653
32	*See* ANL-HEP-CP-86-124		DE87004969	MN -34D	12:14623
CONF-8606220-	(American Institute of Aeronautics and Astronautics meeting on space systems technology, San Diego, CA, USA, 9-12 Jun 1986)				
1	*See* N-86-31981				12:13568
CONF-8606241-	(3. Continuous Electron Beam Accelerator Facility summer school, Newport News, VA, USA, 23-27 Jun 1986)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003925	MN -34D	12:14624
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003926	MN -34D	12:14643
CONF-8606251-	(American Electroplaters Society Foundation surface/finishing '86, Philadelphia, PA, USA, 23-27 Jun 1986)				
1	*See* UCRL-94810	E 1.99:	DE87002684	MN -25	12:13897
CONF-860701-	(23. international conference on high-energy physics, Berkeley, CA, USA, 16-23 Jul 1986)				
67	*See* TRI-PP-86-83		DE87900327	MN -34D	12:14634
68	*See* SLAC-PUB-4139	E 1.99:	DE87004567	MN -34D	12:14633
69	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004579	MN -34D	12:14642
CONF-860704-	(6. CERI world hydrogen energy conference, Vienna, Austria, 20-24 Jul 1986)				
4	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900447	MN -97e	12:13326
CONF-860709-	(Conference on research and applications of aquatic plants for water treatment and resource recovery, Orlando, FL, USA, 20-24 Jul 1986)				
2	IGT, 3424 South State Street, Chicago, IL 60616		TI87900439	MN -61C	12:13333
CONF-860714-	(22. University conference on ceramics - ceramic microstructurea '86: role of interfaces, Berkeley, CA, USA, 28-31 Jul 1986)				
7	*See* SAND-86-0481C		DE87003787	MN -25	12:13777
8	*See* LBL-22162		DE87004470	MN -34D	12:15129
CONF-860759-	(Ordinary Differential Equations (ODE) conference, Albuquerque, NM, USA, 28 Jul-1 Aug 1986)				
Absts.	*See* SAND-86-1753		DE87002196	MN -32	12:15253
CONF-8607102-	(International symposium on microalloying and new processing approaches, Golden, CO, USA, 8-10 Jul 1986)				
1	*See* LBL-21663	E 1.99:	DE87003535	MN -25	12:13769
CONF-8607104-	(INTER/MICRO '86: international conference on microscopy, Chicago, IL, USA, 21-24 Jul 1986)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001544	MN -25	12:13757
CONF-8607105-	(Conference on mathematical aspects of string theory, San Diego, CA, USA, 21 Jul-2 Aug 1986)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004499	MN -34D	12:14663
CONF-8607106-	(2. international meeting on chemical sensors, Bordeaux, France, 7-10 Jul 1986)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87001495	MN -37	12:14167
CONF-860802-	(International nuclear physics conference, Harrogate, UK, 25-30 Aug 1986)				
14	*See* TRI-PP-86-84		DE87900323	MN -34D	12:14676
CONF-860808-	(7. international congress on photosynthesis, Providence, RI, USA, 10-15 Aug 1986)				
10	*See* BNL-38815	E 1.99:	DE87002586	MN -48	12:13358
CONF-860810-	(Intersociety energy conversion engineering conference, San Diego, CA, USA, 25-29 Aug 1986)				
42	*See* N-86-31979				12:13566
43	*See* N-86-31980				12:13567
44	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616; 3		TI87900435	MN -90c	12:13022
46	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900437	MN -90c	12:13015

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CONF-860815-	(11. international conference on electromagnetic isotope separators and techniques related to their applications, Los Alamos, NM, USA, 18-22 Aug 1986)				
12	*See* LA-UR-86-4183	E 1.99:	DE87003732	MN -37	12:14143
13	*See* LA-UR-86-4184	E 1.99:	DE87003733	MN -37	12:14144
CONF-860818-	(American Council for an Energy Efficient Economy Santa Cruz summer study on energy-efficiency in buildings, Santa Cruz, CA, USA, 17-23 Aug 1986)				
14	*See* LBL-21886	E 1.99:	DE87003526	MN -95d	12:13640
15	*See* LBL-21976	E 1.99:	DE87003522	MN -95d	12:13641
16	*See* LBL-20557		DE87004478	MN -95d	12:13639
CONF-860821-	(Gaseous fuels for transportation, Vancouver, Canada, 7-10 Aug 1986)				
1	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900434	MN -92	12:13217
2	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900444	MN -96	12:13729
CONF-860845-	(8. international conference on vacuum ultraviolet radiation physics, Lund, Sweden, 4-8 Aug 1986)				
3	*See* UCRL-94314	E 1.99:	DE87004352	MN -34A	12:14602
CONF-860864-	(Meeting on strongly coupled plasma physics, Santa Cruz, CA, USA, 4-9 Aug 1986)				
4	*See* UCRL-95842	E 1.99:	DE87003820	MN -34	12:13780
5	*See* LA-UR-86-4319	E 1.99:	DE87003748	MN -34	12:15128
CONF-860867-	(International conference on statistical physics, Boston, MA, USA, 11-15 Aug 1986)				
1	*See* BNL-38690	E 1.99:	DE87001471	MN -34C	12:15115
CONF-860880-	(30. SPIE technical symposium on optics and optoelectronic engineering, San Diego, CA, USA, 17-22 Aug 1986)				
42	*See* UCRL-95423	E 1.99:	DE87003468	MN -37	12:13971
CONF-8608130-	(Stellar pulsation conference, Los Alamos, NM, USA, 11-15 Aug 1986)				
4	*See* LA-UR-86-4112	E 1.99:	DE87003719	MN -34B	12:14529
5	*See* LA-UR-86-4109	E 1.99:	DE87003716	MN -34B	12:14526
6	*See* LA-UR-86-4111	E 1.99:	DE87003718	MN -34B	12:14528
7	*See* LA-UR-86-4196	E 1.99:	DE87003736	MN -34B	12:14531
8	*See* LA-UR-86-4110		DE87003717	MN -34B	12:14527
CONF-8608142-	(Review of progress in quantitative NDE, La Jolla, CA, USA, 3-8 Aug 1986)				
1	*See* N-87-10399				12:13775
CONF-8608144-	(Panel study on bonding and adhesion at solid state interfaces for the Council on Materials Science, Aspen, CO, USA, 11-16 Aug 1986)				
1	NTIS, PC A02/MF A01; 1		DE87001514	MN -25	12:13801
CONF-8608146-	(Low-dimensional conductors and superconductors, Quebec, Canada, 24 Aug-6 Sep 1986)				
1	*See* BNL-38924	E 1.99:	DE87003209	MN -25	12:15137
CONF-860905-	(International meeting on low, intermediate and high level waste management - decontamination and decommissioning, Niagara Falls, NY, USA, 14-18 Sep 1986)				
23	*See* DOE/SSDP-0011	E 1.99:	DE87000420	MN -80	12:13522
27	*See* PNL-SA-13797	E 1.99:	DE87004497	MN -70	12:13830
CONF-860908-	(Operability of nuclear power systems in normal and adverse environments meeting, Albuquerque, NM, USA, 29 Sep-3 Oct 1986)				
37	*See* HEDL-SA-3469-FP	E 1.99:	DE87004349	MN -79p	12:13534
CONF-860911-	(192. American Chemical Society national meeting, Anaheim, CA, USA, 7-12 Sep 1986)				
22	*See* SAND-86-2678C	E 1.99:	DE87003039	MN -80	12:13548
CONF-860914-	(Applied superconductivity conference (ASC '86), Baltimore, MD, USA, 28 Sep-4 Oct 1986)				
22	*See* LBL-21296	E 1.99:	DE87003552	MN -28	12:14081
23	*See* LBL-22208		DE87003534	MN -28	12:14065
24	*See* BNL-38852	E 1.99:	DE87003488	MN -28	12:14067
25	*See* BNL-38854		DE87003473	MN -28	12:14068
26	*See* BNL-38855	E 1.99:	DE87003474	MN -28	12:14069
28	*See* LBL-22431	E 1.99:	DE87003530	MN -25	12:13934
29	*See* LBL-22185	E 1.99:	DE87004473	MN -25	12:15138
CONF-860917-	(14. SOFT - symposium on fusion technology, Avignon, France, 8-12 Sep 1986)				
13	*See* SAND-86-2011C		DE87003506	MN -20	12:15198
CONF-860918-	(7. international conference on hyperfine interactions, Bangalore, India, 8-12 Sep 1986)				
3	*See* LBL-22406	E 1.99:	DE87003545	MN -34C	12:14701
CONF-860948-	(3. annual Pittsburgh coal conference, Pittsburgh, PA, USA, 8-12 Sep 1986)				
2	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900445	MN -90	12:13023
3	Institute of Gas Technology, 3424 S. State St., Chicago, IL 60616		TI87900443	MN -90c	12:13024

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CONF-860968-	(3. international conference on the science of technology of zirconia, Tokyo, Japan, 9-11 Sep 1986)			
3	*See* LBL-22367	E 1.99: DE87003523	MN -25	12:13804
CONF-860992-	(Integrating microelectronics into gas distribution symposium, Fontana, WI, USA, 8-10 Sep 1986)			
1	Institute of Gas Technology, 3424 S. State St., Chicago, IL 60616	TI87900451	MN -92	12:13208
2	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616	TI87900452	MN -92	12:13209
3	Institute of Gas Technology, 3424 South State St., Chicago, IL 60616	TI87900453	MN -92	12:13210
CONF-8609127-	(SPIE's fiber LASE '86, Cambridge, MA, USA, 14-26 Sep 1986)			
16	*See* N-86-31793			12:13362
CONF-8609163-	(International conference and symposia on unified concepts of many-body problems, Stony Brook, NY, USA, 4-6 Sep 1986)			
6	*See* TRI-PP-86-103	DE87900321	MN -34C	12:15077
7	*See* BNL-38786	DE87002393	MN -34	12:14506
CONF-8609165-	(International off-highway and powerplant congress and exposition, Milwaukee, WI, USA, 8-11 Sep 1986)			
	Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096			12:13724
CONF-8609190-	(18. summer school on nuclear structure studies by means of nuclear reactions, Mikolajki, Poland, 1-13 Sep 1986)			
2	*See* LBL-21998	E 1.99: DE87003542	MN -34C	12:14831
CONF-8609209-	(Workshop on the relations between structure and reactions in nuclear physics, Philadelphia, PA, USA, 15-18 Sep 1986)			
2	*See* LA-UR-86-4172	E 1.99: DE87003730	MN -34C	12:15075
CONF-8609216-	(5. conference on photovoltaic generators in space, Noordwijk, Netherlands, 30 Sep-4 Oct 1986)			
1	*See* N-86-32521			12:13384
CONF-8609221-	(International school on low energy antiproton physics, Sicily, Italy, 27 Sep-3 Oct 1986)			
1	*See* LA-UR-86-3882	E 1.99: DE87003367	MN -34D	12:15149
CONF-8609223-	(ECFA workshop: LEP 200, Aachen, F.R. Germany, 29 Sep-1 Oct 1986)			
1	*See* SLAC-PUB-4127	DE87003266	MN -34D	12:14654
CONF-8609225-	(Technical working party on the question of international collaboration in fusion materials research, Munich, F.R. Germany, 1-3 Sep 1986)			
1-Vugraphs	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87002816	MN -20c	12:15188
CONF-861002-	(Automotive technology development contractors' coordination meeting, Dearborn, MI, USA, 27-30 Oct 1986)			
4	NTIS, PC A02/MF A01; 1	DE87004403	MN -96	12:13730
5	NTIS, PC A02; 3	DE87004624	MN -25	12:13814
CONF-861007-	(Nuclear science and nuclear power systems symposium, Washington, DC, USA, 29-31 Oct 1986)			
20	*See* TRI-PP-86-99	DE87900325	MN -38	12:14175
21	*See* LBL-21042	E 1.99: DE87003538	MN -38	12:14145
22	*See* LBL-21575	E 1.99: DE87003527	MN -38	12:14146
CONF-861019-	(10. international vacuum congress and 6. international conference on solid surfaces and the 33. national symposium of the American Vacuum Society, Baltimore, MD, USA, 27-31 Oct 1986)			
22	*See* N-87-10960			12:13385
23	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87004266	MN -20	12:15187
CONF-861038-	(OSA/APS international laser science conference, Seattle, WA, USA, 20-24 Oct 1986)			
3	*See* LA-UR-86-4136	E 1.99: DE87003724	MN -34	12:14871
CONF-861044-	(Hanford Life Sciences symposium: radiation protection-a look to the future - celebrating four decades of research at Hanford, Richland, WA, USA, 21-23 Oct 1986)			
6	*See* PNL-SA-14039	DE87004467	MN -41	12:14152
CONF-861070-	(7. biennial Computer Use by Engineers (CUBE) symposium, Livermore, CA, USA, 15-17 Oct 1986)			
Absts.	NTIS, PC A08; 3	DE87003890	MN -32	12:15233
CONF-861076-	(Fall meeting of the Metallurgical Society of AIME, Orlando, FL, USA, 5-9 Oct 1986)			
3	*See* LA-UR-86-4346	E 1.99: DE87003756	MN -25	12:13768
CONF-8610110-	(15. international colloquium on group theoretical methods in physics, Philadelphia, PA, USA, 20-24 Oct 1986)			
3	*See* LA-UR-86-4203	E 1.99: DE87003737	MN -34	12:15150
CONF-8610115-	(4. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 27-31 Oct 1986)			
9	*See* BNL-39001	E 1.99: DE87004174	MN -34A	12:14579
11	*See* LBL-22333	E 1.99: DE87003551	MN -28	12:14083
12	*See* UCRL-95799	DE87003467	MN -21	12:15172

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13	*See* LBL-22385	E 1.99: DE87003537	MN -28	12:14084
14	*See* LBL-22386	DE87003536	MN -20	12:15169
CONF-8610135-	(14. water reactor safety information meeting, Gaithersburg, MD, USA, 27-31 Oct 1986)			
42	*See* BNL-NUREG-39056	TI87004178	MN -78	12:13472
44	*See* SAND-86-2119C	E 1.99: DE87004240	MN -78	12:13547
45	*See* EGG-M-34686	DE87004538	MN -78	12:13525
50	*See* EGG-M-21886	E 1.99: DE87004537	MN -78	12:13524
CONF-8610173-	(11. conference on cyclotrons and their applications, Tokyo, Japan, 13-17 Oct 1986)			
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87004269	MN -28	12:14073
12	*See* TRI-PP-86-91	DE87900407	MN -28	12:14087
13	NTIS, PC A02; 3	DE87003653	MN -28	12:14048
CONF-8610178-	(TRADE conference, Las Vegas, NV, USA, 27-29 Oct 1986)			
3	NTIS, PC A02/MF A01; 1	DE87001826	MN -2	12:15222
CONF-8610188-	(Annual meeting of interchange computer user group, San Diego, CA, USA, 2-11 Oct 1986)			
1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE87000751	MN -32	12:15234
CONF-8610194-	(Symposium on propulsion instrumentation, Jiangyou, China, 6-10 Oct 1986)			
1	*See* N-86-31859			12:14613
CONF-8610195-	(37. congress of the International Astronautical Federation, Innsbruck, Austria, 4-11 Oct 1986)			
1	*See* N-86-32520			12:13383
CONF-8610196-	(European workshop on few body physics, Rome, Italy, 7-11 Oct 1986)			
2	*See* TRI-PP-86-87	DE87900326	MN -34C	12:14708
3	*See* LA-UR-86-3455	E 1.99: DE87001959	MN -34C	12:15074
CONF-8610204-	(Science and technology subcommittee meeting, Newark, NJ, USA, 31 Oct 1986, 31 Oct 1986)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87002624	MN -48	12:14403
CONF-8610207-	(20. ESLAB symposium, Heidelberg, F.R. Germany, 27-31 Oct 1986)			
1	*See* LA-UR-86-4362	DE87003761	MN -34B	12:14532
2	*See* LA-UR-86-3908	E 1.99: DE87003710	MN -34B	12:14524
4	*See* LA-UR-86-3942	DE87003712	MN -34B	12:14525
5	*See* LA-UR-86-3907	E 1.99: DE87003426	MN -34B	12:14523
CONF-8610208-	(Workshop on nonlinear optical techniques for SDI applications, Albuquerque, NM, USA, 28-31 Oct 1986)			
1	*See* SAND-86-2249C	E 1.99: DE87002479	MN -34	12:13969
CONF-8610211-	(Galactic Center conference, Berkeley, CA, USA, 25 Oct 1986, 25 Oct 1986)			
1	*See* LA-UR-86-4157	DE87003729	MN -34B	12:14530
CONF-8610220-	(DOE contractors meeting, Pittsburgh, PA, USA, 21-22 Oct 1986)			
1	*See* SAND-86-1837C	DE87001731	MN -90a	12:13060
CONF-861102-	(American Nuclear Society and Atomic Industrial Forum joint meeting, Washington, DC, USA, 16-21 Nov 1986)			
26	*See* UNI-SA-179	E 1.99: DE87002689	MN -80	12:13486
31	*See* HEDL-SA-3547-FP	E 1.99: DE87004347	MN -38	12:13932
CONF-861106-	(IAEA international conference on plasma physics and controlled nuclear fusion research, Kyoto, Japan, 12-19 Nov 1986)			
15	*See* GA-A-18630	DE87004404	MN -20a	12:15166
CONF-861107-	(Meeting on ceramics: basic science and electronics, New Orleans, LA, USA, 2-5 Nov 1986)			
1	*See* N-86-31913			12:13806
CONF-861111-	(Conference on magnetism and magnetic materials, Baltimore, MD, USA, 17-21 Nov 1986)			
17	*See* BNL-39003	E 1.99: DE87004067	MN -25	12:13745
CONF-861114-	(9. international conference on application of accelerators in research and industry, Denton, TX, USA, 10-12 Nov 1986)			
35	*See* BNL-38868	E 1.99: DE87003481	MN -48	12:15107
36	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE87003655	MN -34A	12:14580
CONF-861143-	(IAEA technical committee meeting on fusion reactor safety, Culham, UK, 3-7 Nov 1986)			
2	*See* EGG-M-34886	E 1.99: DE87004533	MN -20e	12:15193
CONF-861145-	(Eastern oil shale symposium, Lexington, KY, USA, 19-21 Nov 1986)			
1	*See* UCRL-95762	E 1.99: DE87004362	MN -91	12:13228
2	*See* UCRL-95824	E 1.99: DE87004361	MN -91	12:13229
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87003953	MN -91	12:13219
CONF-861146-	(AIChE winter annual meeting, Miami, FL, USA, 2-7 Nov 1986)			
11	*See* N-86-32627			12:13363
12	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87003958	MN -91	12:13220
CONF-861177-	(9. international conference on lasers and applications, Orlando, FL, USA, 3-7 Nov 1986)			
3	*See* LA-UR-86-4210	E 1.99: DE87003739	MN -34	12:14171

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-861195-	(29. meeting of the Weapons Agencies Nondestructive Testing Organization (WANTO), Amarillo, TX, USA, 18-20 Nov 1986)				
2	*See* SAND-86-2753C	E 1.99:	DE87003515	MN -38	12:14007
CONF-8611103-	(20. symposium of North Eastern Accelerator Personnel, Notre Dame, IN, USA, 3-6 Nov 1986)				
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004401	MN -28	12:14049
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004197	MN -28	12:14074
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004396	MN -28	12:14075
CONF-8611106-	(Brookhaven National Laboratory regional utilities seminar life extension, energy/fuels and environment, Upton, NY, USA, 5-6 Nov 1986)				
Absts.	*See* BNL-38874	E 1.99:	DE87002589	MN -13	12:13426
CONF-8611110-	(SEM fall meeting, Keystone, CO, USA, 2-5 Nov 1986)				
1	*See* EGG-M-32786	E 1.99:	DE87001433	MN -25	12:13820
CONF-8611114-	(Norwood Sertoma Club meeting, Knoxville, TN, USA, 12 Nov 1986, 12 Nov 1986)				
1	NTIS, PC A02/MF A01		DE87002622	MN -48	12:14404
CONF-8611115-	(Nuclear explosives code development conference, Albuquerque, NM, USA, 17-20 Nov 1986)				
3	*See* UCRL-95866		DE87004357	MN -34	12:15152
CONF-861204-	(4. Miami international symposium on multi-phase transport and particulate phenomena, Miami Beach, FL, USA, 15-17 Dec 1986)				
1	*See* DOE/ER/13398-3	E 1.99:	DE87003984	MN -38	12:13978
2	*See* DOE/ER/13398-2	E 1.99:	DE87003983	MN -38	12:13977
CONF-861207-	(Materials Research Society fall meeting, Boston, MA, USA, 1-5 Dec 1986)				
22	*See* DP-MS-86-72	E 1.99:	DE87004182	MN -70	12:13819
23	*See* SAND-86-1685C		DE87004245	MN -34	12:15131
24	*See* BNL-39075		DE87004181	MN -34	12:15116
25	*See* BNL-39076	E 1.99:	DE87004170	MN -34	12:13843
26	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004070	MN -25	12:13750
27	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004064	MN -25	12:13751
28	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004275	MN -25	12:13752
29	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004276	MN -25	12:13753
30	*See* BNL-39074	E 1.99:	DE87004180	MN -25	12:13747
31	*See* UCRL-94708		DE87004365	MN -85	12:13295
32	*See* UCRL-95040	E 1.99:	DE87004363	MN -34	12:13970
33	*See* UCRL-94658	E 1.99:	DE87004358	MN -70	12:13835
34	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004277	MN -25	12:14005
35	*See* SAND-86-2800C	E 1.99:	DE87003512	MN -25	12:13834
36	*See* SAND-86-1343C	E 1.99:	DE87003507	MN -25	12:13779
37	*See* SAND-86-1409C	E 1.99:	DE87003513	MN -25	12:13832
38	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004398	MN -25	12:13815
39	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004209	MN -25	12:13754
40	*See* BNL-39073		DE87003435	MN -25	12:13746
41	*See* SAND-86-1821C		DE87004518	MN -25	12:13833
42	NTIS, PC A02/MF A01; 1		DE87004397	MN -25	12:13755
CONF-861211-	(American Society of Mechanical Engineers winter meeting, Anaheim, CA, USA, 7-12 Dec 1986)				
21	*See* LBL-22388		DE87003544	MN -32	12:14612
CONF-861240-	(3. national conference on high power microwave technology for defense applications, Albuquerque, NM, USA, 1-5 Dec 1986)				
5	*See* LA-UR-86-3973	E 1.99:	DE87003714	MN -28	12:14010
10	*See* UCRL-95614	E 1.99:	DE87004354	MN -38	12:15256
CONF-861245-	(Workshop on directions in the study of crisis management, Washington, DC, USA, 5 Dec 1986, 5 Dec 1986)				
1	*See* LA-UR-86-4320		DE87003749	MN -2	12:13597
CONF-870101-	(American Society of Heating, Refrigerating, and Air-Conditioning Engineers meeting, New York, NY, USA, 18-21 Jan 1987)				
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004274	MN -95d	12:13632
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004280	MN -95d	12:13633
CONF-870102-	(4. symposium on space nuclear power systems, Albuquerque, NM, USA, 12-16 Jan 1987)				
8	*See* DOE/NASA/1005-10	E 1.99:	DE86014816	STD -96	12:13489
CONF-870111-	(Annual battery conference on application and advances, Long Beach, CA, USA, 13-15 Jan 1987)				
2	*See* LA-UR-86-4296		DE87003746	MN -96	12:13661
CONF-870115-	(Amorphous silicon subcontractors' review meeting, Palo Alto, CA, USA, 26-27 Jan 1987)				
	See SERI/CP-211-3086		DE87001120	MN -63	12:13365
CONF-870130-	(Technical Society of Knoxville meeting, Knoxville, TN, USA, 5 Jan 1987, 5 Jan 1987)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004281	MN -13	12:15221
CONF-870132-	(LASE-13: pulse power for lasers conference, Los Angeles, CA, USA, 11-16 Jan 1987)				
1	*See* SAND-86-1675C	E 1.99:	DE87003774	MN -21	12:15197

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CONF-870133-	(25. AIAA aerospace sciences meeting, Reno, NV, USA, 12-15 Jan 1987)				
1	*See* SAND-86-1574C		DE87004312	MN -38	12:13938
CONF-870135-	(2. international performance of protective clothing symposium, Tampa, FL, USA, 18-22 Jan 1987)				
1	*See* DP-MS-86-202		DE87004513	MN -41	12:13523
CONF-870201-	(Central hardwood forest conference, Knoxville, TN, USA, 24-26 Feb 1987)				
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004260	MN -48	12:13359
3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004264	MN -61A	12:14300
CONF-870211-	(9. annual symposium on geotechnical and geohydrological aspects of waste management, Ft. Collins, CO, USA, 2-6 Feb 1987)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004061	MN -70A	12:13303
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004060	MN -70A	12:13261
CONF-870219-	(Midyear topical symposium of the Health Physics Society: health physics of radiation-producing machines, Reno, NV, USA, 8-12 Feb 1987)				
7	*See* FNAL/C-86/157		DE87003853	MN -28	12:14096
CONF-870224-	(2. topical meeting on microphysics of surfaces, beams and adsorbates, Santa Fe, NM, USA, 16-18 Feb 1987)				
1	*See* SAND-86-2494C		DE87001739	MN -34A	12:15132
CONF-870242-	(Automation Technology Institute conference, Monterey, CA, USA, 10-12 Feb 1987)				
1	*See* Y/PG-3117		DE87004198	MN -2	12:13921
CONF-870301-	(International topical meeting on remote systems and robotics in hostile environments, Pasco, WA, USA, 29 Mar-2 Apr 1987)				
2	*See* LA-UR-86-3768		DE87002922	MN -41	12:13933
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003008	MN -86	12:13238
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003004	MN -86	12:13239
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003002	MN -86	12:13240
11	*See* DP-MS-86-192		DE87004185	MN -38	12:13930
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003006	MN -86	12:13241
13	*See* DP-MS-86-185		DE87004186	MN -38	12:13929
15	*See* HEDL-SA-3508-FP		DE87004089	MN -79e	12:13512
CONF-870304-	(2. ASME/JSME thermal engineering conference, Honolulu, HI, USA, 22-27 Mar 1987)				
1	*See* SAND-86-0440C	E 1.99:	DE86007392	MN -34	12:14173
2	NTIS, PC A02/MF A01		DE86010527	MN -79b	12:13520
3	*See* SAND-86-0790C		DE86012941	MN -38	12:13997
CONF-870305-	(EMC symposium and exhibition special seminar: EMP effects on power systems, Zurich, Switzerland, 3-5 Mar 1987)				
1	*See* UCRL-94192		DE86008030	MN -38	12:14011
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002415	MN -97	12:13427
CONF-870306-	(Waste management '87, Tucson, AZ, USA, 1-5 Mar 1987)				
3	*See* EGG-M-26986	E 1.99:	DE87000435	MN -70	12:13251
4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004272	MN -70B	12:13816
CONF-870307-	(ASME/JSME/ISES solar energy conference, Honolulu, HI, USA, 22-27 Mar 1987)				
1	*See* SAND-86-1286C		DE86015400	MN -61D	12:13396
2	*See* SAND-86-1588C	E 1.99:	DE86015403	MN -62	12:13388
3	*See* EGG-M-20686		DE87000480	MN -66d	12:13419
4	*See* SAND-86-1733C	E 1.99:	DE87003037	MN -59A	12:13389
5	*See* SAND-86-1380C		DE87003156	MN -63	12:13377
6	*See* SAND-86-1172C		DE87002701	MN -62a	12:13409
11	*See* SAND-86-2851C	E 1.99:	DE87003502	MN -63	12:13378
12	*See* SAND-86-1291C	E 1.99:	DE87003509	MN -62	12:13386
14	*See* SERI/TP-252-3013	E 1.99:	DE87001123	MN -62a	12:13391
CONF-870314-	(Corrosion '87, San Francisco, CA, USA, 9-13 Mar 1987)				
1	*See* DP-MS-86-178	E 1.99:	DE87002653	MN -70	12:13264
2	*See* DP-MS-86-51	E 1.99:	DE87002646	MN -25	12:13263
4	*See* BNL-NUREG-38836		TI87002587	MN -78	12:13519
6	*See* SAND-86-0936C		DE87003508	MN -25	12:13778
CONF-870317-	(Solar pond science and technology: a seminar to spread in Latin America the knowledge on solar ponds, Cuernavaca, Mexico, 23-28 Mar 1987)				
1	*See* SERI/TP-252-3088	E 1.99:	DE87001124	MN -59B	12:13411
CONF-870323-	(American Institute of Chemical Engineers spring national meeting, Houston, TX, USA, 29 Mar-2 Apr 1987)				
1	Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI87900456	MN -92	12:13064
CONF-870335-	(International conference on radiation dosimetry and safety, Taipei, China, 2-4 Mar 1987)				
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003654	MN -41	12:14423
CONF-870357-	(2. topical meeting on machine vision, Lake Tahoe, NV, USA, 18-20 Mar 1987)				
1	*See* SAND-86-2602C		DE87002869	MN -15	12:13314

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CONF-870410-	(193. national meeting of the American Chemical Society, Denver, CO, USA, 5-10 Apr 1987)				
8	*See* UCRL-95618		DE87002555	MN -91	12:13227
CONF-870601-	(Annual meeting of the American Nuclear Society, Dallas, TX, USA, 7-12 Jun 1987)				
4	NTIS, PC A02/MF A01		DE87004422	MN -34C	12:14095
COO-					
2185-16	*See* DOE/EV/02185-T2	E 1.99:	DE87003985	MN -11	12:14360
CRC-					
547	*See* AD-A-173825/1/XAB				12:14225
CRDEC-TR-					
86046	*See* AD-A-173233/8/XAB				12:13865
86048	*See* AD-A-173177/7/XAB				12:13864
CRIEPI-					
285015	Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.				12:13025
285029	Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan Energy and Environment Lab.				12:13105
285030	Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.				12:13026
285032	Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.				12:13130
285049	Central Research Inst. of Electric Power Industry, Komae, Tokyo, Japan. Energy and Environment Lab.				12:13106
481017	Central Research Inst. of Electric Power Industry, Abiko, Chiba, Japan. Bio-Environment Lab.				12:13107
CSIR-RR-					
624	NTIS (US Sales Only), PC A04/MF A01		DE86780498	MN -11	12:14206
CSIRO-DG-GCM-					
61	Commonwealth Scientific and Industrial Research Organization, Mount Waverley, Australia. Div. of Geomechanics				12:13116
62	Commonwealth Scientific and Industrial Researach Organization, Mount Waverley, Australia. Div. of Geomechanics				12:13117
CSTB-MPE-					
418	NTIS (US Sales Only), PC A03/MF A01; 1		DE87750975	MN -95d	12:13602
419	NTIS (US Sales Only), PC A03/MF A01; 1		DE87750976	MN -95d	12:13634
CTA-IEAV-NT-					
014/ 84	NTIS (US Sales Only), PC A04/MF A01		DE86780499	MN -79	12:15235
DCN-					
86-203-023-57-08	*See* PB-87-141032/XAB				12:13059
DFVLR-FB-					
85-35	*See* ESA-TT-59				12:14043
86-42	NTIS (US Sales Only), PC A03/MF A01; 1		DE87751174	MN -11	12:14207
DFVLR-MITT-					
85-09	*See* ESA-TT-50				12:13837
85-09	*See* ESA-TT-50				12:13838
85-09	*See* ESA-TT-50				12:13839
DGRST-					
79-7-1514	NTIS (US Sales Only), PC A05/MF A01		DE87750970	MN -94d	12:13323
80-7-0655	NTIS (US Sales Only), PC A02/MF A01		DE87750971	MN -96	12:13719
81-F-0409	NTIS (US Sales Only), PC A03/MF A01		DE87750972	MN -96	12:13720
DHHS/PUB/NIOSH-					
86-101	*See* PB-87-104725/XAB				12:13140
DOE/BC/99880-					
15	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001215	STD -92a	12:13187
DOE/CE-					
0034/ 5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003968	STD -4	12:13319
DOE/CE/15295-					
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003497	MN -38	12:13928
DOE/CE/26519-					
T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003904	MN -95d	12:13715
DOE/CE/40699-					
T6	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004382	MN -95f	12:13676
DOE/CE/63474-					
T3	NTIS, PC A04; 3		DE87004193	MN -95d	12:13635
T4	NTIS, PC A04; 3		DE87004194	MN -95d	12:13636
DOE/CE/63477-					
T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004458	MN -95	12:13637
DOE/CE/90234-					
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004011	MN -38	12:13975
DOE/CH/10280-					
1	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99:	DE87003216	MN -11	12:13262
DOE/CS/30078-					
T1	NTIS, PC A02/MF A01; 1		DE87004318	MN -63a	12:13375
DOE/EH-					
0017	NTIS, PC A09; 3		DE87003060	MN -80	12:13521
DOE/EIA-					
0121(86/ 3Q)	NTIS, PC A07/MF A01 - GPO; 1 (GPO Dep.)	E 1.99:	DE87004811	MN -98A	12:13137

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0370(86)	NTIS, PC A99/MF A01 - GPO; 1 (GPO Dep.)	E 1.99:	DE87004338	MN -98	12:13143
0466(85)	NTIS, PC A03/MF A01 - GPO; 1 (GPO Dep.)	E 1.99:	DE87004339	MN -98	12:13579
0487(85) / 2	NTIS, PC A17/MF A01 - GPO; 1 (GPO Dep.)	E 1.99:	DE87004340	MN -98B	12:13176
0502	NTIS, PC A03/MF A01 - GPO		DE87004815	MN -98A	12:13138
DOE/ER/02490-4	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004296	MN -20	12:15189
DOE/ER/03071-22	NTIS, PC A05/MF A01; 1		DE87004793	MN -34D	12:14622
DOE/ER/03244-T4	NTIS MF A01; 2 (GPO Dep.)	E 1.99:	DE87004298	MN -34D	12:14702
DOE/ER/04936-12	NTIS, PC A06/MF A01; 1		DE87005301	MN -34C	12:14884
DOE/ER/10587-T3	NTIS MF A01; 2 (GPO Dep.)	E 1.99:	DE87004299	MN -34D	12:14625
DOE/ER/10873-1	NTIS, PC A02/MF A01; 1		DE87004586	MN -48	12:14400
DOE/ER/10979-13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004306	MN -34	12:15139
14	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004307	MN -34	12:13953
DOE/ER/12022-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004374	MN -38	12:13976
DOE/ER/13048-3	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004196	MN -21	12:15190
DOE/ER/13147-2-Pt.9	NTIS, PC A02/MF A01		DE87000765	MN -34	12:15140
DOE/ER/13158-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004380	MN -25	12:13736
DOE/ER/13163-13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004237	MN -25	12:13737
DOE/ER/13262-3	NTIS, PC A05/MF A01; 1		DE87005300	MN -34A	12:14581
DOE/ER/13332-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004411	MN -34A	12:14582
DOE/ER/13368-3	NTIS, PC A02/MF A01; 1		DE87004394	MN -48	12:14391
DOE/ER/13398-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003983	MN -38	12:13977
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003984	MN -38	12:13978
DOE/ER/13436-1	NTIS, PC A02; 3		DE87003416	MN -4	12:13868
DOE/ER/40015-1	NTIS, PC A02; 3		DE87004504	MN -34C	12:14885
DOE/ER/40030-3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004410	MN -34D	12:14626
DOE/ER/40153-3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004132	MN -34D	12:14664
DOE/ER/40200-043	NTIS, PC A02; 3		DE87004327	MN -34D	12:14644
053	NTIS, PC A02; 3		DE87004328	MN -34D	12:14645
054	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004329	MN -34	12:14502
056	NTIS, PC A02; 3		DE87004330	MN -34D	12:14665
057	NTIS, PC A02/MF A01; 1		TI87004331	MN -34D	12:14666
058	NTIS, PC A02; 3		DE87004332	MN -34D	12:14667
059	NTIS, PC A02; 3		DE87004333	MN -34D	12:14668
060	NTIS, PC A02; 3		DE87004334	MN -34D	12:14669
077	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004391	MN -34D	12:14670
078	NTIS, PC A03/MF A01; 1		DE87004388	MN -34D	12:14671
082	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004389	MN -34D	12:14672
083	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004390	MN -34D	12:14646
DOE/ER/40215-T6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003921	MN -34D	12:14673
DOE/ER/40257-002	NTIS, PC A02/MF A01; 1		DE87004419	MN -34D	12:14168
DOE/ER/45134-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004409	MN -34A	12:15117
DOE/ER/45148-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004315	MN -25	12:13758
DOE/ER/45161-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004297	MN -25	12:13817
DOE/ER/45206-3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004131	MN -25	12:13759
DOE/ER/45210-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004135	MN -25	12:13818
DOE/ER/45238-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87004083	MN -34	12:15118
DOE/ER/53164-13	NTIS, PC A02/MF A01; 1		DE87004585	MN -20b	12:15191
DOE/ER/53203-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003979	MN -20b	12:15192
DOE/ER/60106-5	NTIS, PC A03/MF A01		DE87004503	MN -11	12:14208
DOE/ER/60210-T1	NTIS MF A01; 2		DE87004423	MN -41	12:14405

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DOE/ER/60432-4	NTIS, PC A02/MF A01		DE87004493	MN -41	12:13910
DOE/ER/60435-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004081	MN -11	12:14358
DOE/ER/60451-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003988	MN -48	12:14359
DOE/ER/71045-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004373	MN -11	12:14488
DOE/ET/53088-141	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004482	MN -20g	12:15162
243	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004204	MN -20f	12:15163
263	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004483	MN -20g	12:15164
DOE/EV/02185-T2	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003985	MN -11	12:14360
DOE/EV/10374-3-Final	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004323	MN -41	12:14295
DOE/FE/60177-2245	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004383	MN -91	12:13221
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2251	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004460	STD -91	12:13223
DOE/FE/60600-T10	NTIS, PC A11; 3		DE87004294	MN -92	12:13198
DOE/HWP-22	NTIS, PC A03/MF A01; 1		DE87004164	STD -69	12:14343
DOE/IE-0007	NTIS, PC A02/MF A01; 1		DE87004227	MN -97	12:13614
DOE/MA-0286	NTIS, PC A03/MF A01; 1		DE87005266	MN -13	12:15223
DOE/MA/00194-H1	NTIS, PC A16; 3		DE87004570	MN -13	12:15217
DOE/MC/20229-2200	NTIS, PC A05/MF A01; 1		DE87001038	STD -90	12:13437
DOE/MC/21175-2257	NTIS, PC A10/MF A01; 1		DE87003352	STD -90d	12:13734
DOE/MC/21186-2260	NTIS MF A01; 2 (GPO Dep.)	E 1.99:	DE87004199	STD -90h	12:13760
DOE/METC-86/ 6046	NTIS, PC A04/MFA01; 1		DE86006591	MN -91	12:13218
DOE/NASA-0247/ 2	*See* N-87-10531				12:13423
DOE/NASA/1005-10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86014816	STD -96	12:13489
DOE/NASA/50112-68	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87005210	STD -96	12:13727
DOE/NBM-7003140	NTIS, PC A04/MF A01 - GPO		TI87003140	MN -80	12:13508
DOE/NE-0079	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004572	STD -78	12:13460
0080	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE87005199	STD -78	12:13473
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T265	NTIS, PC A07/MF A01; 1		DE87004877	MN -98C	12:13203
DOE/PC/40782-T7	NTIS, PC A03/MF A01; 1		DE87002559	MN -90d	12:13027
DOE/PC/40795-T13	NTIS, PC A02/MF A01		DE87004506	MN -90d	12:13028
DOE/PC/50266-T1	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99:	DE86015048	STD -90b	12:13131
DOE/PC/50791-T4	NTIS MF A01; 2		DE87000287	MN -90d	12:13029
DOE/PC/70006-T7	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004509	MN -90d	12:13065
DOE/PC/70042-T6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004215	MN -90d	12:13030
DOE/PC/70770-6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004119	MN -90a	12:13132
DOE/PC/70799-T7	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003848	MN -90d	12:13066
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DOE/PC/70801-T9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004498	MN -90d	12:13031
DOE/PC/70805-8	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004384	MN -90a	12:13121
DOE/PC/80009-T19	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004157	MN -90d	12:13168
DOE/PC/80502-T3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004013	MN -90a	12:13032
DOE/PC/80503-T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004233	MN -90a	12:13067
DOE/PC/80507-T5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004238	MN -90c	12:13033
DOE/PC/80519-5	NTIS, PC A02/MF A01		DE87005038	MN -90a	12:13068

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DOE/PC/80541-T5	NTIS, PC A02; 3		DE87004247	MN -90i	12:14361
DOE/PC/80907-T4	NTIS, PC A02; 3		DE87003999	MN -90d	12:13034
DOE/PC/80908-2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004117	MN -90a	12:13035
DOE/PC/81208-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003882	MN -90b	12:13036
DOE/PC/81210-T13	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004381	MN -90b	12:13016
DOE/PC/90507-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87004115	MN -90b	12:13069
DOE/PC/90508-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003838	MN -90d	12:13070
DOE/PC/90518-1	NTIS, PC A04/MF A02; 1 (GPO Dep.)	E 1.99:	DE87003906	MN -90i	12:14233
DOE/PC/90519-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004210	MN -90a	12:13071
DOE/PC/90520-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004368	MN -90a	12:13072
DOE/PC/90521-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004480	MN -90a	12:13037
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DOE/PC/90534-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004583	MN -90d	12:13073
DOE/PC/90962-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004486	MN -90b	12:13979
DOE/PC/91021-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004128	MN -90i	12:13449
DOE/PETC/QTR-86/3	NTIS, PC A08/MF A01; 1		DE87005062	MN -90d	12:13014
DOE/S-0051	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002724	MN -80	12:13461
DOE/SF/00098-T10	NTIS, PC A02/MF A01; 3		DE87003013	MN -48	12:14402
DOE/SF/00515-T72	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003941	MN -28	12:14050
DOE/SF/12196-23	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002936	MN -66a	12:13417
DOE/SSDP-0011	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87000420	MN -80	12:13522
DOE/TIC-4579-Rev.14-Pt.1	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99:	DE87000365	MN -13	12:15218
4579-Rev.14-Pt.2	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99:	DE87000366	MN -13	12:15219
DOT/FAA/AM-86/8	*See* AD-A-173031/6/XAB				12:14454
DOT/FAA/CT-86/21	*See* AD-A-174091/9/XAB				12:13174
DP-MS-86-51	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002646	MN -25	12:13263
86-72	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004182	MN -70	12:13819
86-176	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004184	MN -12	12:14362
86-178	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87002653	MN -70	12:13264
86-185	NTIS, PC A02/MF A01; 1		DE87004186	MN -38	12:13929
86-192	NTIS, PC A02/MF A01; 1		DE87004185	MN -38	12:13930
86-202	NTIS, PC A02/MF A01; 1		DE87004513	MN -41	12:13523
DPH-N-S-2313	*See* CEA-CONF-8262		DE87750765	MN -34C	12:14872
DPST-85-793	NTIS, PC A04; 3		DE87004512	MN -70A	12:13265
86-1-11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004293	MN -2	12:13518
DREO-935	*See* AD-A-173721/2/XAB				12:14091
DTNSRCD-TM-27-80-19	*See* AD-A-173434/2/XAB				12:13673
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2934	*See* N-86-31729				12:13805
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3037	*See* N-86-31980				12:13567
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3166	*See* N-86-31913				12:13806
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3204	*See* N-86-31859				12:14613
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3268	*See* N-87-10960				12:13385
ECN-					
85-42	ECN, P.O. Box 1, 1755 ZG Petten, The Netherlands				12:13108
ECTB-					
112-21B	*See* PB-87-114708/XAB				12:14272
ECTB-CT-					
149-33	*See* PB-87-107579/XAB				12:14265
EFI-					
86-19	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004576	MN -34D	12:14674
EGG-					
2455	*See* NUREG/CR-4616		TI87004461	MN -78	12:13543
2461	*See* NUREG/CR-4672		TI87004485	MN -78	12:13544
2470	*See* NUREG/CR-4734		TI87004463	MN -78	12:13545
2483	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004564	STD -70	12:13266
10282-2125	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004457	MN -11	12:14342
10282-2131	NTIS, PC A03/MF A01; 1		DE87004426	MN -48	12:14301
EGG-EP-					
7394	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004544	MN -20a	12:15165
EGG-M-					
20686	NTIS, PC A02/MF A01; 1		DE87000480	MN -66d	12:13419
21886	NTIS, PC A02/MF A01 - GPO; 1 (GPO Dep.)	E 1.99:	DE87004537	MN -78	12:13524
26986	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87000435	MN -70	12:13251
32786	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87001433	MN -25	12:13820
34686	NTIS, PC A02/MF A01; 1		DE87004538	MN -78	12:13525
34886	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004533	MN -20e	12:15193
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7376	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004543	MN -41	12:13526
7402	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004529	MN -78	12:13527
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556	NTIS (US Sales Only), PC A03/MF A01		DE86780500	MN -78	12:13463
559	NTIS (US Sales Only), PC A03/MF A01		DE86780501	MN -80	12:13528
560	NTIS (US Sales Only), PC A03/MF A01		DE86780502	MN -34C	12:15102
563	NTIS (US Sales Only), PC A05/MF A01		DE86780503	MN -70	12:13267
564	NTIS (US Sales Only), PC A03/MF A01		DE86780504	MN -77	12:13485
566	NTIS (US Sales Only), PC A04/MF A01		DE86780505	MN -34C	12:14886
567	NTIS (US Sales Only), PC A03/MF A01		DE86780506	MN -78	12:13474
569	NTIS (US Sales Only), PC A04/MF A01		DE86780507	MN -41	12:13308
570	NTIS (US Sales Only), PC A03/MF A01		DE86780508	MN -80	12:15236
571	NTIS (US Sales Only), PC A02/MF A01		DE86780509	MN -78	12:13475
573	NTIS (US Sales Only), PC A03/MF A01		DE86780510	MN -80	12:13510
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86/ 6	NTIS (US Sales Only), PC A03/MF A01		DE87900400	MN -11	12:13845
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81-138	NTIS (US Sales Only), PC A08; 3		DE87750948	MN -69	12:13678
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4995-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303		TI87920187	ND -90	12:13039
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4900-SR	NTIS, PC A14/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1 (GPO Dep.)	E 1.99:	DE87003411	MN -95e	12:13348

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4918-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920155	ND -90	12:13450
4925	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920152	ND -25	12:13931
4950	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920148	ND -90	12:13438
4968	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920191	ND -90f	12:13439
4987	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920193	ND -90	12:13133
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4740	NTIS, PC A09/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1 (GPO Dep.)	E 1.99: DE87004106	MN -11	12:14308
4973	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920195	ND -41	12:14456
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4744	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920200	ND -97a	12:13452
4863	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920120	ND -97c	12:13453
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4979	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920198	ND -97b	12:13454
4980	Research Reports Center, Box 50490, Palo, Alto CA 94303	TI87920199	ND -97c	12:13428
4981	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920201	ND -97b	12:13455
4983	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920197	ND -97	12:13440
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4599-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920204	ND -97e	12:13552
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4599-Vol.4	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920206	ND -94e	12:13554
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4599-Vol.7	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920209	ND -97e	12:13557
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4701	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920173	ND -96	12:13564
4896	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920170	ND -32	12:15237
4965	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920203	ND -59A	12:13395
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4988-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920213	ND -95f	12:13624
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4222-Vol.4	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920216	ND -78	12:13464
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4574-CCM-Pt.2-Ch.7-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920229	ND -78	12:13468
4574-CCM-Pt.2-Ch.7-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920230	ND -78	12:13469
4574-CCM-Pt.2-Ch.12-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920214	ND -78	12:13470
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4941	NTIS, PC A06/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; 1 (GPO Dep.)	E 1.99: DE87004110	MN -78	12:13529
4971	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920177	ND -78	12:13478
4972	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920245	ND -78	12:13530
4998	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920243	ND -41	12:13479
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5028	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI87920249	ND -13	12:13620
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1894	NTIS (US Sales Only), PC A07/MF A01	DE87750974	MN -96	12:13336
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2005	NTIS (US Sales Only), PC A04/MF A01; 1	DE87751170	MN -25	12:13875
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364	NTIS (US Sales Only), PC A03/MF A01	DE87751176	MN -48	12:14461
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86-3907	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003426	MN -34B	12:14523
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20557	NTIS, PC A02/MF A01; 1		DE87004478	MN -95d	12:13639
21042	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003538	MN -38	12:14145
21296	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003552	MN -28	12:14081
21575	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003527	MN -38	12:14146
21663	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003535	MN -25	12:13769
21758	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003547	MN -28	12:14082
21886	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003526	MN -95d	12:13640
21976	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003522	MN -95d	12:13641
21998	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003542	MN -34C	12:14831
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22185	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004473	MN -25	12:15138
22208	NTIS, PC A02; 3		DE87003534	MN -28	12:14065
22333	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003551	MN -28	12:14083
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22385	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003537	MN -28	12:14084
22386	NTIS, PC A02/MF A01; 1		DE87003536	MN -20	12:15169
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22554	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003548	MN -28	12:14053
22579	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004592	MN -34D	12:14631
22634	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004598	MN -34	12:15130
22647	NTIS, PC A09; 3		DE87004601	MN -25	12:13770
22652	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004471	MN -25	12:13827

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012/ 85	NTIS (US Sales Only), PC A02/MF A01	DE86780542	MN -80	12:13991
018/ 85	NTIS (US Sales Only), PC A02/MF A01	DE86780543	MN -38	12:13992
019/ 85	NTIS (US Sales Only), PC A02/MF A01	DE86780544	MN -78	12:13482
LPI-TR-				
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LPS-				
343	*See* CONF-8505100-19	DE87003366	MN -20a	12:15161
MINTEK-M-				
270	NTIS (US Sales Only)03/MF A01; 1	DE87900462	MN -25	12:13771
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28	NTIS, PC A13/MF A01			12:14601
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3411	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE87004555	STD -15	12:13313
MLM-MU-				
87-61-0022	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87004637	MN -32	12:15265
MMS-				
85-0011	*See* FWS/OBS-82/47.1	TI87900418	MN -11	12:14302
86-0127-Vol.2	Minerals Management Service, 18th and C Streets, NW, Washington, DC 20240	TI87900478	MN -92a	12:13180
86-0127-Vol.3	Minerals Management Service, 18th and C Streets, NW, Washington, DC 20240	TI87900479	MN -92a	12:13181
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86-31702	NTIS HC A02/MF A01			12:13773
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86-31912	NTIS HC A02/MF A01			12:14006
86-31913	NTIS HC A02/MF A01			12:13806
86-31979	NTIS HC A02/MF A01			12:13566
86-31980	NTIS HC A02/MF A01			12:13567
86-31981	NTIS HC A02/MF A01			12:13568
86-32348	NTIS HC A05/MF A01			12:14535
86-32520	NTIS HC A02/MF A01			12:13383
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86-32557	NTIS HC A02/MF A01			12:13774
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88803	*See* N-86-31680			12:13565
88815	*See* DOE/NASA/1005-10	E 1.99: DE86014816	STD -96	12:13489
88829	*See* N-86-31859			12:14613
88832	*See* N-86-32627			12:13363
88833	*See* N-86-31793			12:13362
88842	*See* N-86-32557			12:13774
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88855	*See* N-87-10399			12:13775
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83	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE87001213	STD -92b	12:13231
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25	NTIS (US Sales Only)06/MF A01; 1	DE87900431	MN -48	12:14407
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61	NTIS (US Sales Only), PC A03/MF A01	DE86780545	MN -11	12:14322
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7751165	NTIS (US Sales Only), PC A03/MF A01; 1		DE87751165	MN -97	12:13622
7751166	NTIS (US Sales Only), PC A04/MF A01; 1		DE87751166	MN -95f	12:13681
7751167	NTIS (US Sales Only), PC A02/MF A01; 1		DE87751167	MN -98	12:13608
7751168	NTIS (US Sales Only), PC A02/MF A01; 1		DE87751168	MN -98	12:13609
7751169	NTIS (US Sales Only), PC A02/MF A01; 1		DE87751169	MN -92	12:13613
7751249	NTIS (US Sales Only), MF A01; 2		DE87751249	MN -97c	12:13444
7751253	NTIS (US Sales Only), PC A05/MF A01; 1		DE87751253	MN -11	12:14304
7751256	NTIS (US Sales Only), PC A03/MF A01; 1		DE87751256	MN -38	12:13662
7751257	NTIS (US Sales Only), PC A19/MF A01; 1		DE87751257	MN -98	12:13610
7751259	NTIS (US Sales Only), PC A08/MF A01; 1		DE87751259	MN -11	12:14363
7751261	NTIS (US Sales Only), PC A04/MF A01; 1		DE87751261	MN -90e	12:13134
7770055	NTIS (US Sales Only), PC A06/MF A01; 1		DE87770055	MN -11	12:14501
7770056	NTIS (US Sales Only), PC A07/MF A01; 1		DE87770056	MN -38	12:13995
7770057	NTIS (US Sales Only), PC A07/MF A01; 1		DE87770057	MN -90d	12:13053
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7900409	US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458		TI87900409	MN -11	12:14381
7900410	US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458		TI87900410	MN -11	12:14346
7900465	US Fish and Wildlife Service, 1010 Gause Boulevard, Slidell, LA 70458		TI87900465	MN -11	12:14347
7900466	US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458		TI87900466	MN -11	12:14348
7900467	US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458		TI87900467	MN -11	12:14349
7900480	SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486		TI87900480	MN -90	12:13080
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5829	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87000784	MN -21	12:15196
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504	NTIS (US Sales Only), PC A07/MF A01		DE86780547	MN -80	12:13515
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0540-Vol.8-No.10	NTIS, PC A21/MF A01 - GPO		TI87900458	MN -2	12:13491
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4222	NTIS, PC A08/MF A01 - GPO		TI87003109	MN -80	12:13541
4544	NTIS, PC A09/MF A01 - GPO		TI87004367	MN -78	12:13467
4567	NTIS PC E19/MF $12.10 - GPO		TI87900169	MN -80	12:13542
4616	NTIS PC E05/MF A01 - GPO		TI87004461	MN -78	12:13543
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4734	NTIS, PC A03/MF A01 - GPO		TI87004463	MN -78	12:13545
4792-Vol.4	NTIS, PC A06/MF A01 - GPO		TI87004262	MN -78	12:13546
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101	KRTA Ltd., Auckland, New Zealand				12:13081
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86-0084	Minerals Management Service, 1951 Kidwell Dr., MS 642, Suite 601, Vienna, VA 22180		TI87900414	MN -92a	12:13179
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5889	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004056	STD -11	12:14444
6328	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE87005295	MN -32	12:15248
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238	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004023	MN -32	12:15249
239	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE87005293	MN -71	12:13252
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193	NTIS, PC A11/MF A01 (GPO Dep.)	E 1.99:	DE86015934	MN -11	12:14382
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84-89680/ 1	NTIS, PC A05; 3		DE87005274	MN -95d	12:13642
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10062	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE87005279	MN -70	12:13305
10078	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE87004058	MN -70B	12:13306
10166	NTIS, PC A03/MF A01; 1	DE87005297	MN -95f	12:13644
10200	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE87005273	STD -20g	12:15170
10260	NTIS, PC A02/MF A01; 1	DE87005287	MN -32	12:15250
ORNL-tr-				
86/ 74	NTIS, PC A02/MF A01; 1	DE87004643	MN -78	12:13483
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9950.1	*See* PB-87-107751/XAB			12:14384
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6049-Vol.2	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004084 STD -85	12:13255
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86/ 1022	*See* PB-87-107405/XAB			12:13146
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86-0440C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007392 MN -34	12:14173
86-0481C	NTIS, PC A02/MF A01		DE87003787 MN -25	12:13777
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86-0954	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004553 STD -70	12:13292
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86-1172C	NTIS, PC A02/MF A01; 1		DE87002701 MN -62a	12:13409

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86-1291C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87003509	MN -62	12:13386
86-1343C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003507	MN -25	12:13779
86-1380C	NTIS, PC A02/MF A01; 1		DE87003156	MN -63	12:13377
86-1409C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003513	MN -25	12:13832
86-1472	NTIS, PC A04/MF A01; 1		DE87004442	MN -32	12:15252
86-1492	NTIS, PC A04/MF A01; 1		DE87003962	STD -62a	12:13387
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86-1588C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86015403	MN -62	12:13388
86-1675C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003774	MN -21	12:15197
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86-1821C	NTIS, PC A02/MF A01		DE87004518	MN -25	12:13833
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86-2011C	NTIS, PC A02/MF A01; 1		DE87003506	MN -20	12:15198
86-2119C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87004240	MN -78	12:13547
86-2249C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE87002479	MN -34	12:13969
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86-2800C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE87003512	MN -25	12:13834
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86-022	State Electricity Commission of Victoria, Melborune, Australia. Brown Coal Research Div.				12:13136
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85-93	State Electricity Commission of Victoria, Melborune, Australia. Brown Coal Research Div.				12:13114
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LB	Lebanon
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RO Romania
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SE Sweden
SG Singapore
SK Sikkim
SL Sierra Leone
SM San Marino
SN Senegal
SO Somalia
SU Union of Soviet Socialist Republics (USSR)
SV El Salvador
SY Syria
SZ Swaziland

TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VE Venezuela
VI Virgin Islands of the United States
VN Viet Nam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

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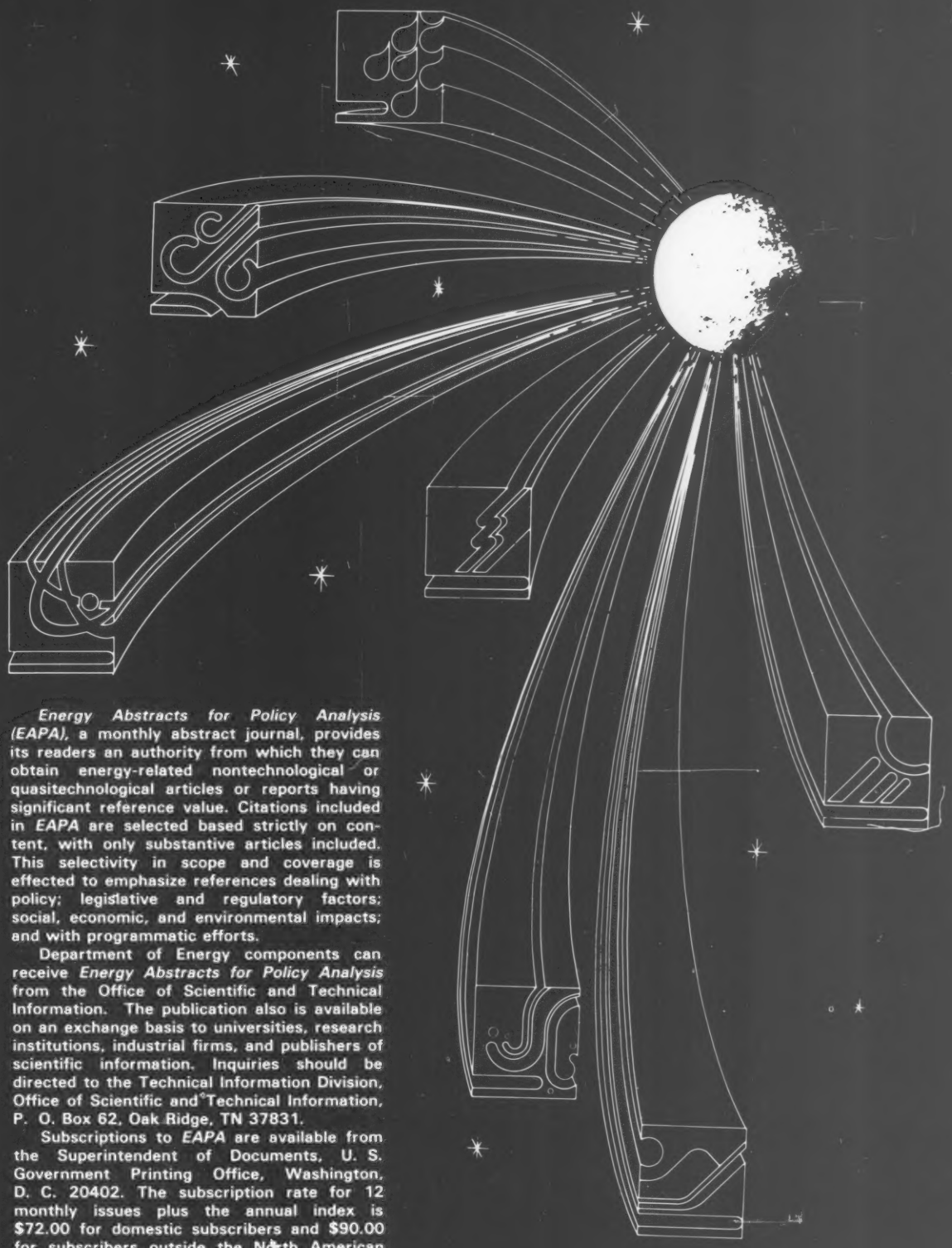

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